



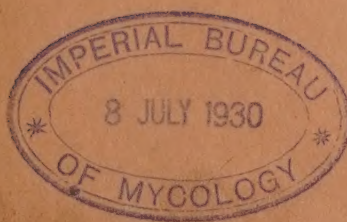
NYASALAND PROTECTORATE

# Annual Report

of the

# Department of Agriculture

# 1929









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ZOMBA

PRINTED AND PUBLISHED BY THE GOVERNMENT PRINTER

NYASALAND.





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Farm Manager	W. L. MILLER

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# Report of the Department of Agriculture for the year 1929.

## EUROPEAN AGRICULTURE.

The year under review has been a trying one for the greater proportion of the agricultural community, owing to general over production in most parts of the world, with the inevitable serious fall in prices for practically all commodities. The seriousness of the situation at the end of the year in so far as it affects this territory cannot be deduced from the ensuing statistics of acreage, production, and export, as it is not a characteristic of British farmers to abandon their enterprise on the first indications of decline. Details of the returns for each district will be found in "Annexure D", whilst the following summary shows the changes that have taken place during the past year, as well as the position of the major crops in comparison with their status in 1919.

	1919	1928	1929
Coffee ... ..	492	1,281	1,331
Cotton ... ..	12,658	1,046	1,219
Fibre, Sisal ... ..	3,290	7,863	8,270
Rubber ... ..	4,000	1,400	1,330
Tea ... ..	4,840	7,596	8,866
Tobacco ... ..	9,817	22,475	19,269
Miscellaneous ... ..	12,684	20,569	19,892
Total ... ..	<u>47,781</u>	<u>63,230</u>	<u>60,177</u>

It will be noted that in comparison with the previous year and ten years ago, there has been a moderate increase of three perennial crops, coffee, tea, and sisal, and a decline in one perennial crop, rubber, whilst of the two annual crops cotton is only one tenth of what it was in 1919, and tobacco has declined approximately 14 per cent. in comparison with the previous year. The large acreage of miscellaneous crops does not strictly denote a diversified agriculture which will be reflected in the Protectorate exports, as approximately 13,000 acres is accounted for by artificially established timber and firewood areas, the remainder being devoted partly to food crops for native labour and live stock and partly to legumes for green manuring.

Exports of agricultural produce in any year cannot be definitely correlated with the production in that year, as the annual carry over varies considerably, particularly in the case of tobacco and cotton. It is none the less interesting to compare exports with previous exports, more especially in respect of weight. Values being locally assessed, may vary considerably with realised values, but average out fairly reliably over a long period. It should be noted that it is not possible to differentiate the European and Native proportions of tobacco and cotton which are exported in any year.

	1919		1928		1929	
	Tons	Value £	Tons	Value £	Tons	Value £
Coffee ... ..	50	2,801	26	1,542	41	3,239
Cotton ... ..	415	55,475	797	58,264	947	62,660
Fibre ... ..	212	8,959	1,161	29,814	1,200	34,464
Rubber ... ..	53	8,988	52	2,476	77	3,344
Tea ... ..	358	33,479	637	73,599	783	74,388
Tobacco ... ..	1,938	271,397	5,148	496,561	4,611	403,678
Miscellaneous ... ..	273	8,273	104	6,567	1,042	4,670
Total ... ..	<u>3,299</u>	<u>389,372</u>	<u>7,925</u>	<u>668,823</u>	<u>8,704</u>	<u>586,438</u>

*Tobacco.*—The acreage, production, and yield per acre during 1929, according to statistics returned by planters was as follows:—

District	Acreage	Production cwt.	Yield per acre lbs.
Cholo ... ..	5,415	10,669	221
Blantyre ... ..	2,823	6,939	275
Zomba ... ..	2,706	6,263	260
Mlanje ... ..	1,398	2,479	200
South Nyasa ... ..	1,322	3,646	309
Ncheu ... ..	1,286	3,152	275
Lilongwe ... ..	1,268	4,695	414
Chiradzulu ... ..	1,255	2,880	261
Dowa ... ..	486	1,575	367
Central Shire ... ..	481	1,152	268
Dedza ... ..	376	866	258
Fort Manning ... ..	181	418	260
North Nyasa ... ..	90	400	498
Upper Shire ... ..	88	392	498
Lower Shire ... ..	58	107	206
Chikwawa ... ..	56	155	310
Total ... ..	<u>19,269</u>	<u>45,788</u>	<u>266</u>

The season, more particularly in the Southern and Zomba provinces, was distinctly unfavourable from a climatic point of view, owing not so much to an excessive amount of rain apart from the month of January, as to its distinctly even distribution over a very long period, with the concomitant absence of bright sunshine. This resulted in much disease developing in the crop, particularly in the higher districts, and is largely responsible for the average yield per acre being only 266 lbs, as against 405 lbs per acre in the previous year, and this in spite of the tendency to grow more of the heavy yielding fire cured types on many estates owing to the poor market for brights. There is



however no doubt that the reduced yield can in part be attributed to the stringent financial position of many planters who were consequently unable to afford fertilisers on the usual scale or to employ sufficient labour to ensure the desired amount of cultivation. The crop generally was indifferent in quality as well as small in bulk, and this coupled with the low prices ruling owing to large stocks remaining unsold in the United Kingdom, resulted in but few planters being able to improve their already critical financial position.

*Cotton*—There was no substantial increase on the previous year's meagre acreage, and it is doubtful whether this crop will ever receive as much attention from Europeans as it received prior to 1920, unless market prices advance substantially, and larger yields are assured than have been customary. A fair degree of interest is shown in small scale trials of varieties favoured by the Cotton Specialist of the Empire Cotton Growing Corporation, but it is not probable that these will lead to greatly increased acreages. The crop in the past thrived moderately in the higher levels so long as new lands could be cleared, but this gradually became impossible, and as the organic matter in the cleared soils decreased, the cotton crop became less and less reliable. Whilst it is extremely easy to deprive a soil of its essential constituents, they are not all easily restored, even with ample financial resources, and the moral implied in the proverb "One year's seeding means seven years weeding" is applicable to many other agricultural practices or malpractices.

*Tea*—Steady progress continues to be made in the development of this industry, in spite of the general tendency for lower prices to be obtained for the manufactured product in common with other commodities, and attention to the various aspects of the culture is becoming more and more intensive. A Tea Research Association was formed toward the end of the year, and whilst its present financial resources are insignificant, it is evidence of a progressive spirit among the growers which deserves every encouragement and financial assistance, both from private and public sources. Reference is made elsewhere to the appointment of a Mycologist, and to a visit from Dr. H. H. Storey of Amani to investigate an obscure disease, but quite apart from this welcome assistance, there is a crying need for a general tea experimental station. This is however a task beyond the present resources of a small industry which is being developed with slender financial reserves. The problems which require investigation are numerous and cannot be solved in a brief period even when ample facilities are provided. Among the most important may be included the fertiliser deficiencies of various soil types, the effect of fertilisers on yield, on quality, on diseases and insect pests, a study of the different jats or "varieties" of bush, their adaptation to soil types, to climatic variations, inherent yielding capacity, and quality of product, their tendency to breed true or to vary, and if the latter, methods of asexual propagation in order to establish uniform gardens of desirable varieties.

The doubtful outlook for tobacco and the poor crop often obtained particularly in some areas subjected to excessive rainfall, has encouraged attempts to establish tea on some erstwhile tobacco estates, where rainfall will sometimes be rather too low for this particular crop. Whilst tea is extraordinarily adaptable in that it will exist under a very wide range of climatic conditions, it is an entirely different proposition to secure conditions which, in conjunction with appropriate management, will lead to the economic production of manufactured tea. The enterprise will be watched with considerable interest, and it is to be hoped that in such doubtful areas a policy of small acreage with intensive treatment will be the rule rather than the exception.

*Coffee*—A slight increase in acreage is recorded in comparison with the previous year, mainly due to efforts to establish the crop in the North Nyasa district. From time to time suggestions are made that coffee ought once more to become the principal crop of the Protectorate, as it was thirty years ago. I would prefer coffee to any other crop as our main export, but am convinced that it is not possible to attain that state—except by practically ceasing to grow other crops. There are small areas where coffee can and should be grown, but prospective growers should consult the Department before deciding.

*Sisal*—This crop continues to develop in a satisfactory manner, in spite of falling prices, and if only more moderate freight rates could be assured, it would be possible to increase the acreage and export very considerably, but mainly in proximity to the railway, and below the 2,000 foot contour.

Having regard to all existing factors affecting European agriculture at the end of the year, it is extremely difficult to conclude my review in an optimistic manner. The general fall in prices for all commodities on the world markets is due to overproduction and not to decreased demand or to inability to purchase. This being so, comparatively little improvement may be expected in selling prices in the near future, as producers in all parts of the world are usually disinclined to decrease their output until compelled financially. To keep our or any agricultural community solvent methods must be sought whereby the costs of production can be lowered. Unquestionably the most crippling factor that our producers have to contend with in comparison with their rivals in other parts of the world, is transport from estate to market principally, but not exclusively, on the railways. Apart from export rates, many of those on imports are equally crippling, and particularly fertilisers, which ought to be used on a far larger scale. There is economic justification for rates on imported fertilisers being reduced very considerably, or even being conveyed free—not from charitable motives, but because one ton of fertiliser properly utilised will lead to many additional tons of return freight owing to the increased crops which will be produced.

#### NATIVE AGRICULTURE.

Apart from the production of cotton and tobacco for export, there is little in connection with native agriculture that can be shown statistically. In the case of the above crops, the native production during the year 1929 was 63 per cent. of the total in the case of tobacco, as against 37 per cent. of the total in 1928, whilst of the total cotton production of the Protectorate the already high percentage of native production was raised from 93 per cent. to 96.5 in the year under review.



**Tobacco**—The 1929 crop was the highest yet recorded, exceeding that of 1927 by 376 tons. In comparing the production in these two exceptional years, it is noted that there was a decrease of 796 tons in the Southern Province, an increase of 59 tons in the Zomba Province, and an increase of 1,134 tons in the Central Province (a small proportion of the tobacco shown for the latter is actually produced in the adjacent portions of the Northern Province in most years). The decline in the south and the increase in the Central Province can be largely attributed to the same influences. In the former the soils having been under cultivation for a long period, are relatively infertile, whilst those in the Central Province are comparatively newly opened and fertile. In a normal season the rainfall in the south is above the optimum for tobacco, whereas in the Central Province it is below optimum, and, the 1929 growing season being wetter than usual, with a reduction of sunshine at the critical period, the abnormal conditions benefitted the Central Province, but caused loss to the south. Finally, the policy of the Native Tobacco Board having been to concentrate on the Central Province, results might be expected to be in accordance with those revealed in the statistics. It should be noted that production of tobacco by natives is not restricted to those living on Crown Lands, although the activities of the Native Tobacco Board are restricted to the latter. Of the total 1929 crop, in the Southern and Zomba Provinces, native tenants on private estates produced 26 per cent. of the whole, whereas in the Central Province, only 7 per cent. of its total of 2,765 tons was produced by natives on privately owned lands.

The following statistics show the relation of the 1929 production to that of the four preceding years, whilst comparative statistics for each district are shown in comparison with those of the previous year only :—

PRODUCTION 1925-1929					
	1925	...	...	...	Tons
	1926	...	...	...	1,177
	1927	...	...	...	2,023
	1928	...	...	...	3,484
	1929	...	...	...	2,414
					3,881
PURCHASES IN DISTRICTS					
				1928	1929
				Tons	Tons
SOUTHERN PROVINCE	{ Mlanje	...	...	143	168
	{ Cholo	...	...	81	76
	{ Blantyre	...	...	150	176
	{ Chiradzulu	...	...	474	408
				848	828
ZOMBA PROVINCE	{ Zomba	...	...	204	282
	{ Upper Shire	...	...	13	5
	{ South Nyasa	...	...	5	1
				222	288
CENTRAL PROVINCE	{ Ncheu	...	...	50	55
	{ Dedza	...	...	22	104
	{ Lilongwe	...	...	820	1,801
	{ Dowa	...	...	445	795
	{ Fort Manning	...	...	5	10
				1,342	2,765
NORTHERN PROVINCE	{ Kasungu	...	...	1	*
	{ Kota Kota	...	...	1	*
				2	
				2,414	3,881

\* Sold in Dowa district, and not separately recorded.

NUMBER OF NATIVES REGISTERED AS TOBACCO GROWERS					
				1927/1928	1928/1929
SOUTHERN PROVINCE	{ Mlanje	...	...	1,861	3,255
	{ Cholo	...	...	242	329
	{ Blantyre	...	...	1,000	2,277
	{ Chiradzulu	...	...	8,085	7,362
				11,188	13,223
ZOMBA PROVINCE	{ Zomba	...	...	2,044	5,669
	{ Upper Shire	...	...	215	387
	{ South Nyasa	...	...	51	23
				2,310	6,079
CENTRAL PROVINCE	{ Ncheu	...	...	938	539
	{ Dedza	...	...	920	1,659
	{ Lilongwe	...	...	10,720	15,764
	{ Fort Manning	...	...	479	520
	{ Dowa	...	...	6,110	7,114
				19,167	25,596
NORTHERN PROVINCE	{ Kasungu	...	...	672	1,000
	{ Kota Kota	...	...	1,424	1,680
				2,096	2,680
				34,761	47,578

The percentage of growers on Crown lands in 1928/29 was as follows: Southern Province 80 per cent.; Zomba Province 50 per cent.; Central Province 97 per cent.; Northern Province 100 per cent.

The policy of controlling the issue of seed, and ensuring better cultivation, topping and curing, through the employment of European Supervisors in the Central Province, was continued with satisfactory results, in spite of severe handicaps owing to the enormous area each supervisor has to cover, the difficulty of securing carriers during the rainy season, and the waste of time involved at a critical period of the crop's growth through the staff having been required to supervise lay-out and erection of the central buying stations referred to later. There is



however much that remains to be done in order to put the industry on a really sound basis. The number of supervisors should be increased and their area of supervision reduced, but the limiting factor is the funds at the disposal of the Board. The auxiliary native instructors require to be collected each year for a month's intensive instruction by one of the more experienced European supervisors and they also need to be raised to a higher state of efficiency. A really satisfactory native staff can only be obtained by the assurance of a higher wage than is possible at present, as it is a more attractive proposition for an energetic native to earn an equal sum of money by six months work on his own tobacco crop, followed by six months leisure.

During the past year an innovation in the marketing of the crop in the Lilongwe and Dowa districts was tested. Hitherto licensed buyers in effect established themselves at any point they chose within a district, and bought such tobacco as was brought to them. The Board, in consultation with the District Commissioners, established eight buying centres in the above mentioned districts, these as far as possible being arranged along the main roads of the districts. The buyers stands were arranged at equal distances apart within a fenced area, and all tobacco had to be passed into this enclosure after inspection by an officer of the Board, after which the grower was at liberty to sell to any of the buyers established within the enclosure. The standard of leaf approved as suitable for sale was advisedly moderate only, the intention being to raise the standard by degrees, and consequently in the past season rejections comprised leaf with uncured stems, leaf that was unduly moist, or green leaf, less attention being given to leaf that was not graded into suitable sizes and qualities. The innovation was viewed with some degree of uneasiness by the buyers, but practically all admitted after a little experience that it was a great success whilst the growers benefitted by the instruction given in the classing of the leaf, learnt much by association with growers from distant villages, and probably obtained better prices through the close association of buying premises of competitive buyers. The number of buying stations exceeding the number of regular supervisors, it was necessary to engage temporary inspectors to undertake the grading at certain stations. This procedure is expensive, as it is useless to employ a person unacquainted with tobacco, whilst the terms offered by large buyers in the way of wages and/or commission on purchases of leaf, provides a very tempting alternative form of temporary employment. It must be realised that as buyers pay tax on the *weight* of leaf purchased, which provides the Board's sole revenue, the revenue from any year's crop will be increased or decreased proportionately to the amount of medium and low grade leaf that is passed or rejected.

*Cotton*—It is extremely satisfactory to be able to report a marked advance in the production over the previous record crop of 1925, the increase being almost 600 tons of seed cotton, in spite of the North Nyasa district, producing 158 tons in 1925, being a non producer in 1929. The total production during each of the past ten years for the Protectorate with the comparative district production in the past two years, is revealed in the following statements:—

SEED COTTON				TONS
1920	...	...	...	315
1921	...	...	...	375
1922	...	...	...	392
1923	...	...	...	747
1924	...	...	...	1,369
1925	...	...	...	2,909
1926	...	...	...	2,197
1927	...	...	...	1,387
1928	...	...	...	2,486
1929	...	...	...	3,505

DISTRICT PRODUCTION				1928	1929
				TONS	TONS
Lower Shire	...	...	...	1,377	1,809
Chikwawa	...	...	...	889	1,248
Central Shire	...	...	...	129	195
Mlanje	...	...	...	10	14
Blantyre	...	...	...	4½	10
Upper Shire	...	...	...	8	18
South Nyasa	...	...	...	1½	18
Ncheu	...	...	...	19	47
Dedza	...	...	...	11	51
Dowa	...	...	...	37	95
				<u>2,486</u>	<u>3,505</u>

As in recent years the crop was purchased by the British Cotton Growing Association according to the terms of their agreement with Government, the prices paid per lb of seed cotton being No. 1, 2d., and 1½d. No. 2, 1½d. and 1d., and No. 3, ¾d., the total amount disbursed to native growers for the crop being £61,141 as against £43,603 in the previous season. Rather over 93 per cent. of the crop was produced in the Southern Province, and that mainly in the Shire valley. The future for cotton is not easy to forecast, but having regard to general world conditions and to rival fibres now largely used in fabrics, it is not likely that prices will advance far beyond 10d. for middling for many years to come. If this assumption is correct it would probably be better to fix a price for each grade which would be the same for all districts year by year. After all the native is far more likely to remain a steady producer if he is assured of 20s. for the same weight of the same quality cotton year by year than if he receives say 18s. in one year and 22s. in another, and steady production, with a very gradual upward tendency, is far more to be desired by all sections of the community



than alternate booms and slumps. Further whilst there are theoretical advantages in free competition, there is little doubt that in the case of our cotton industry, free competition in the purchase of the crop would bring in so many practical disadvantages that its early extinction would be the direct result.

The bulk of the cotton so far produced by native growers is of the type that has been in cultivation during the past twenty years, as the amount produced by strains released by the Empire Cotton Growing Corporation is still rather small. An interesting problem is raised by the varying proportions of No. 1, No. 2 and No. 3 cotton purchased at the various buying stations, as set out below, and it is desirable to ascertain the factors which lead to such diverse results. The personal factor will be involved to some extent, as different buyers will grade a given sample much higher or lower than its true grade. Intelligence versus apathy on the part of the growers will account for some variation, whilst date of planting, good or bad cultivation, incidence of rain and of insect pests will all have a definite effect from year to year and from place to place.

			per cent.	per cent.	per cent.
			No.1	No.2	No.3
<b>LOWER SHIRE</b>					
Nyachikadza	...	...	81.4	17.4	1.2
Ndamera	...	...	89.9	9.0	1.1
Chimombo	...	...	88.5	9.8	1.7
Port Herald	...	...	86.5	12.5	1.0
Kalumbo	...	...	90.4	7.3	2.3
Tengani	...	...	89.1	6.6	4.3
Chiromo	...	...	84.9	14.7	0.4
Muona	...	...	86.7	11.0	0.3
Lalanje	...	...	84.2	15.77	0.03
<b>CHIKWAWA</b>					
Munga	...	...	86.3	13.6	0.1
Makwira	...	...	94.6	3.8	1.6
Maperera	...	...	87.1	12.5	0.4
Mitoli	...	...	92.8	4.2	3.0
Tombendera	...	...	79.0	9.0	12.0
Nkadana	...	...	84.9	1.8	13.3
<b>BLANTYRE</b>					
Lisungwe	...	...	81.1	17.8	1.1
Kambalame	...	...	76.3	22.9	0.8
Kumtemwe	...	...	64.0	29.0	7.0
Chigaru	...	...	74.3	24.7	1.0
<b>MLANJE</b>					
Palombe	...	...	69.4	29.8	0.8
<b>NCHEU</b>					
Nchana	...	...	82.0	15.8	2.2
Balaka	...	...	82.0	4.0	14.0
Kambuku	...	...	84.8	0.8	14.4
<b>DEDZA</b>					
Dedza	...	...	79.8	3.9	16.3
Chikuti	...	...	68.6	14.0	17.4
<b>DOWA</b>					
Nansatu	...	...	81.4	5.8	12.8
Salimu	...	...	93.3	4.1	2.6
<b>UPPER SHIRE</b>					
Ulongwe	...	...	68.7	2.5	28.8
<b>SOUTH NYASA</b>					
Fort Johnston	...	...	76.1	23.6	0.3
Malembo	...	...	56.1	43.9	—
Changali	...	...	68.9	30.5	0.6

The local manager of the British Cotton Growing Association and his staff have as hitherto been unsparing in their efforts to develop the crop in all districts, and it is a great pleasure to acknowledge this practical co-operation.

Reference to the removal of the embargo on the cultivation of cotton in the North Nyasa district which had been enforced owing to the presence of pink bollworm will be found in the report of the Entomologist ("Annexure A"). As this decision was not made until practically the end of the year, the production of appreciable quantities of cotton in this district will probably require several years of experiment and propaganda.

**Food Crops**—The production of food crops throughout the Protectorate may be considered to have been satisfactory, thanks to satisfactory rains in most districts. Reference was made in the previous report to the distribution of a quantity of Potchefstroom Pearl maize seed. This generally grew well, as might have been expected. A number of plots were set out in various districts to test the yield capacity of this variety as against the common native type. The Mlanje experiments showed that the imported variety was in no way superior. This can be attributed to the fact that it was bred up to give satisfactory results in areas with a much lower rainfall than is normal in Mlanje. In the Central Province, where climatic conditions are rather more in accordance with those of Rhodesia and the Transvaal, the comparative yield experiments showed

the imported variety to be decidedly superior. This fact should not in itself be sufficient to justify attempts at the rapid replacement of the native stocks by the imported variety. The latter has been subjected to years of intensive breeding and selection, whereas the native type has received no attention from plant breeders. There is no doubt that the native prefers the flour from his own grain to that from the imported variety, owing to the lower percentage of bran in the former. Another enormous advantage from the native point of view is that the local varieties are far more resistant to the ravages of weevil, grain moth, etc., than are the imported dent grains, an important quality for those who cannot afford the luxury of air tight bins and carbon bisulphide for fumigation. Although spectacular results may not be expected so quickly, it is not improbable that the best service would be rendered to the native by refraining from the distribution of varieties which have been evolved elsewhere, for entirely different purposes, and to be grown under quite different conditions, and to concentrate on the improvement of the local varieties by breeding and selection. No experienced person would advocate the extinction of the native breed of cattle, and its replacement by imported Red Polls or Shorthorns. A cautious infiltration of imported blood into the local breed might possibly be advocated, and the like procedure may be expected to give the best result with the natives staple food crop. Unfortunately as in so many other instances, the soundest methods of procedure are often slow and there is great temptation to resort to superficial methods.

#### GENERAL.

*District Agricultural Work*—The report of Mr. F. Barker, District Agricultural Officer, whose headquarters were at Fort Johnston, is attached ("Annexure B"). Since his departure on leave the area has been neglected, and the small experimental station closed. The Lower River districts were without a regular District Agricultural Officer from May, 1928, until November, 1929. Some assistance to native growers was possible by the occasional employment of Mr. G. M. Boby in the Chiromo area, and of Mr. J. F. Logie, in the cotton area of the Central Province, as in the previous year.

The whole position with regard to native agricultural work is and has been most unsatisfactory, and the main cause is lack of the necessary funds. When so little has been available it has been difficult to decide what shall receive attention, knowing that so much must perforce be utterly neglected, and the tendency has been to concentrate on export crops, such as cotton and tobacco, and hope for the best in other directions. As it is doubtful whether Nyasaland will for many years attain the affluence of some other territories, it would appear that so far as native agriculture is concerned, a given sum of money will be expended to the greatest advantage by training and employing the maximum of native instructors who will be kept up to a state of efficiency by the firm control of the District Commissioners, working in conjunction with a small but mobile force of European District Agricultural Officers.

*Native Tobacco Board*—Some reference to the operations of the Board are recorded elsewhere. The staff was entirely concentrated in the Central Province as from May 1st, and was increased by the appointment of an additional Supervisor, and an Agent, the duties of the latter being administrative, and so permitting Supervisors to give more exclusive attention to travelling and giving cultural instruction to the growers. At the end of the year the European staff consisted of an Agent and six Supervisors, with 90 native instructors. The revenue for the year derived from tax on tobacco purchases amounted to £9,375 4s. 9d. and the expenditure was £7,969 12s. 4d. Revenue derived from sale of seed and leaf from the Board plots, etc., amounted to £2,064 7s. 7d.

The duties of the Board as defined by section 5 of The Tobacco Ordinance, consist of supervising and assisting native tobacco growers, and it may therefore be assumed that any expenditure of its funds in other directions would be contrary to the spirit of this section of the Ordinance. It having been felt that much useful work could be done by the staff in connection with other aspects of native agriculture concurrently with their activities in relation to the tobacco crop, a select committee of the Legislative Council was appointed to report on the advisability of forming a Native Agricultural Board with duties far more comprehensive than those of the present Board. The report of the Select Committee favoured such change.

*Experimental Work*—There is little to report under this heading other than will be found in Annexures A, B and C, as items of interest in connection with the small experimental station near Zomba were embodied in the report of the Agricultural Chemist which was submitted by him prior to his proceeding on leave in June, 1929.

Toward the end of the year recommendations were submitted for the establishment of an experimental farm in close association with modern research laboratories for the scientific officers. Whilst no situation can be expected to be suitable for the acquisition of information which can be usefully applied to all parts of the Protectorate, it is eminently desirable that there should be a principal institution, and that subsidiary experimental stations should be established in various parts of the Protectorate to investigate problems which arise from peculiar soil, climatic or other conditions.

*Empire Cotton Growing Corporation*.—A summary of the Corporation's activities in Nyasaland during 1929 is attached ("Annexure C"). The Makwapala and Port Herald stations were carried on much as in 1928, and proposals previously made for the establishment of a station in the Dowa district, in the vicinity of Domira Bay, received approval in time for clearing operations to take place, permitting planting toward the end of 1929. When this station becomes fully established it is possible that Makwapala could be dispensed with, in so far as cotton is concerned, though the station could in many other respects continue to be utilised with advantage.

The general interest which has been evoked through the introduction of the "U. 4" variety of cotton was maintained. Whilst the season was admittedly a favourable one for cotton in most



districts, it is to be hoped that "U 4" will be subjected at an early date to really adverse conditions, in order that its weaknesses, if any, may be revealed, before "Over the Top" has been discarded. It is not improbable that "U 4" has merely returned to Nyasaland after a tour of some years in which it has been rejuvenated in Uganda, the Transvaal and Southern Rhodesia.

Mr. Ducker and the other members of the Corporation staff continued to co-operate with the Department in every possible way during the year.

*Visiting Specialists*—A discussion extending over several years with regard to the possibility of obtaining the temporary assistance of a specialist in fruit culture with the view to ascertaining whether we could give greater diversity to our export crops, resulted, thanks to a grant made by the Empire Marketing Board, in the visit of Mr. I. Tribolet, late Chief Horticulturist of the Union of South Africa, to report on the possibility of successfully establishing a tree nut industry. Whilst we are most grateful for this assistance it is to be regretted that the visit was productive of negative results. Mr. Tribolet was escorted to various portions of the Southern, Zomba and Central Provinces that were considered to be in any degree suitable for such crops, but suitable soil and climatic conditions did not appear to be associated in any district. The critical factor is the distribution of rainfall, that of Nyasaland being exclusively of the type with wet summers and dry winters, whereas the majority of the edible nuts of commerce thrive in countries where the rainfall is evenly distributed, or, if sharply differentiated seasons occur, success is obtained where the winters are wet and the summers dry. Judging by the behaviour of one nut in Southern Rhodesia and Nyasaland, it is believed that some success would follow properly conducted experiments with the Pecan nut. This is a native of the Southern United States of America, where it occurs mainly in deep rich soils of river bottoms. Recollection of this fact will show the futility of planting it on high land with shallow soils or in soils which become very dry during several months of the year. Even in suitable soils and situations, probably at elevations of from 2,500 to 4,500 feet, it will take ten or more years for trees to produce an appreciable crop. This nut, provided suitable varieties are obtained, is rather like, and but little inferior to a choice walnut.

Toward the end of the year a brief visit was made by Mr. N. Breton on behalf of the Advisory Committee on Silk Production of the Imperial Institute of which he is Chairman. This is commented on in the Entomologist's report, and will receive further consideration when Mr. Breton's report and recommendations have been received.

The Department and the tea planting community were favoured in the latter part of the year by a visit, which lasted some eight weeks, from Dr. H. H. Storey, Plant Pathologist of the East African Agricultural Research Institute, Amani. The object of Dr. Storey's visit was to investigate a peculiar and serious condition of numerous tea bushes on various estates, which had baffled all previous investigators, including Dr. Butler of the Imperial Bureau of Mycology. It was fortunate that Dr. Storey's arrival coincided with that of Mr. R. Leach, on first appointment as Government Mycologist, and arrangements were at once made for the two to be associated in the attack on the problem. No definite conclusions had been arrived at when Dr. Storey had to leave, but an elaborate series of experiments had been set out, and these are being followed up by Mr. Leach, whose headquarters will remain in the tea belt at all events until the experiments are completed.

*Conferences*—The Director of Agriculture whilst on leave attended the conference in London of Meteorologists of the Empire, as the representative of this Government. The Agricultural Chemist also attended a conference on Agricultural Meteorology which was held in conjunction with the above, and presented a paper on "Weather and Tobacco". Mr. Wortley arranged for the transmission to the Department of all literature issued to him in connection with this conference, after he had accepted the offer of transfer as Director of Agriculture, Trinidad. The Director of Agriculture also represented Nyasaland at the Imperial Mycological Conference, held in London.

The Acting Director had been appointed as the Nyasaland delegate to the Pan-African Agricultural Congress, which was held in Pretoria between July 27th and August 17th, a portion of the session being held conjointly with those of the Agricultural Section of the British Association for the Advancement of Science, but in consequence of the deplorably reduced departmental staff, he had with reluctance to refrain from participation in a most important function.

#### PUBLICATIONS ISSUED IN 1929.

##### *Entomological Series :*

Bulletin No. 5.—"Insects in Tobacco Seedbeds," Colin Smee, D.I.C., F.E.S.

Bulletin No. 6.—"Locusts and their Destruction," Colin Smee, D.I.C., F.E.S.

##### *Agronomic Series :*

Circular No. 4.—"Conditions for Tea Growing," A. J. W. Hornby, M.B.E., B.Sc., A.I.C.

*Staff*—The staff was depleted to an abnormal degree in the latter half of the year, officers being absent on leave as follows:—

Mr. E. J. Wortley, Director of Agriculture, from May 13th to December 31st.

Capt. A. J. W. Hornby, Agricultural Chemist, from June 2nd to December 31st.

Mr. F. Barker, District Agricultural Officer, from September 22nd to December 31st.

Capt. R. M. Antill, Senior Tobacco Supervisor, from July 31st to December 31st.

Mr. W. P. Tylor, Senior Tobacco Supervisor, from June 2nd to December 24th.

The Lower River districts were without a District Agricultural Officer from January 1st to November, when Mr. E. Lawrence arrived on first appointment. He had however served on the local staff of the Empire Cotton Growing Corporation prior to his present appointment, and thanks

to the assistance of the Corporation had been enabled to undertake a long course of special studies whilst on leave.

The research staff of the Department was strengthened by the arrival on November 4th of Mr. R. Leach, as Mycologist, an appointment that had been desired for many years.

In addition to his normal duties which involve considerable travelling, the Entomologist visited the North Nyasa district on two occasions to investigate the pink bollworm problem, his second visit lasting for about two months.

The unduly small clerical staff, which has never been adequate for giving all the desirable assistance to the officers of the Agricultural, Forestry and Veterinary Departments, was in effect diminished in the latter portion of the year by the substitution of the services of a learner for those of a more experienced officer. The uneconomical practice of compelling relatively highly paid technical officers to waste valuable time on many things which could be done as effectively by a clerical officer on a lower rate of pay will no doubt be realised in course of time.

Whilst many thanks are extended to all officers of the Department, as well as those of the Empire Cotton Growing Corporation and the Native Tobacco Board, for their conscientious work, I cannot refrain from drawing special attention to the interest shown and the assistance given both in departmental matters and in his capacity as Secretary of the Native Tobacco Board by the Senior Clerk. Without his loyal and ungrudging help, I should have found it impossible to cope even with routine duties, as owing to the depleted staff I was compelled to travel far more than would normally be the case.

May 5th, 1930.

E. W. DAVY,  
Acting Director of Agriculture.

*List of Annexures.*

- "A" Report of Government Entomologist,
- "B" Report of District Agricultural Officer, Fort Johnston.
- "C" Report of Cotton Specialist.
- "D" Agricultural Statistics.



## Report of the Entomological Division.

Owing to my absence on leave during the greater part of 1928 no report was issued for that year, the work done in the early months being included in the report for 1927 and the remainder in this current report.

*Travelling*—During the year some 4,000 miles have been covered by motor transport in connection with advisory and experimental work on estates. A rapid preliminary visit to the North Nyasa district in July was followed by a period of two months (October and November) spent in that area on work in connection with the possibility of permitting the renewal of cotton growing.

*Visits*—In August, Dr. G. A. K. Marshall, C.M.G., Director of the Imperial Bureau of Entomology, made a short stay in the Protectorate. As most of the time at his disposal was occupied with the subject of tse-tse fly, it was only possible for him to allot a few hours to the Entomological Division.

Dr. H. H. Storey, of the Amani Institute, paid a visit of some two months in the latter part of the year in connection with that particular tea disease hitherto termed "The Unknown Disease," and which has been considered as possibly being due to a virus.

In December, Mr. N. Breton, an expert in sericulture, made a short tour of the Protectorate with a view to investigating the possibilities of establishing a silk industry among the natives. Pressure of other work prevented my accompanying Mr. Breton on his tour, but I was able to obtain considerable information from him prior to his departure.

*Buildings and Equipment*—Two fumigation chambers have been erected during the period under review, one at Fort Johnston and one at Blantyre. The latter it is hoped will be conveniently situated to fit in with any railway extension, but it is regretted that the former has been placed in a position to which access is, at present, somewhat difficult.

An existing room in the present Agricultural Offices has been slightly enlarged and altered, and, though giving little more actual space than the quarters occupied at present, will be more convenient in plan and situation. The absence of water and heat supplies is still a considerable drawback, but in view of the probable establishment of entirely new Research Laboratories the immediate provision of these might entail unnecessary expense.

A compound microscope, personally selected, was procured in England in 1928, the first after more than six years, to form part of the equipment of the Entomological Division. A large museum-type of insect cabinet was ordered during the year, in which it will be possible to house in a suitable manner the basis of a representative collection of the insects of the Protectorate.

*Review of General Agricultural Work*—Normally a considerable amount of work quite unconnected with Entomology has to be carried out every year, but this has been much augmented during the past period owing to the transition in some districts from the planting of tobacco to other crops, in particular tea. An increased interest in tea-growing swept over certain areas with such amazing rapidity that it seemed very possible that some places with unsuitable climatic conditions might be rushed into the planting of tea. For this reason comparative meteorological tables, made as comprehensive as possible, for tea districts in India, Ceylon and the local tea belt, as well as the coffee areas of Kenya were drawn up, and an attempt made to ascertain whether all the local areas in which it was desired to plant tea could be considered suitable for such a crop. These tables were sent to, or discussed personally with, a large number of planters interested in the subject. It was quite apparent that some areas where tea was being looked upon as a possible alternative to tobacco would be very doubtfully suited to this crop as a paying proposition. Attention was therefore directed to the possibility of combining coffee with tobacco in these areas. The almost complete elimination of coffee as a product of the Protectorate has made work on this subject somewhat difficult. "*Coffee in the old days*" is by now almost a legend and is surrounded with the mystery usual to a legend, with the inevitable result that accurate information concerning its rapid decline and abandonment as a paying crop is practically unobtainable. It is impossible to expect that coffee will ever rise again to the prominence it once held in the economics of the Protectorate, but under conditions of proper attention and in suitable, carefully selected areas, there would seem sound reason to believe that it could be combined with tobacco. One of the biggest difficulties encountered in raising interest in coffee has been the fact that all the best soil has been desired for tobacco and it has frequently been proposed that the coffee shall be relegated to the poorer parts of the estate and left to look after itself—an attitude which is grossly unfair to the coffee plant. A series of articles dealing with coffee cultivation in general were prepared and published in four successive issues of the *Nyasaland Times* in October.

Early in the year the suggestion was put forward that a native coffee industry might perhaps be developed in the Misuku Hills of the North Nyasa district. A very brief visit was paid to this area in October and a report submitted. The almost complete lack of information on the agricultural and climatic conditions of this area rendered it impossible to make a definite statement concerning the possible success or failure of such a project, and though it was considered worthy of a trial, *if properly carried out*, it would be unwise to be too sanguine as to the ultimate development of an extensive native industry.

The type of work outlined above, which of necessity deals with such subjects as planting, seedbeds, green manuring, cultivation, shading, pruning and so forth, naturally prohibits consecutive Entomological studies. The appointment of a Mycologist to the Protectorate in the latter part of the year was a development of the very greatest assistance, nevertheless, as was pointed out in the Annual Report for 1926, the Entomological problems requiring immediate attention are more numerous than can be successfully dealt with so long as this extraneous work falls on the Entomological Division. When after considerable information has been published, cases are noticed or information is received, of coffee being planted on unstumped land or hundreds of acres being planted up without adequate European supervision; of tea being planted at enormous acreages per day in a similar manner to tobacco; or of cattle dip being sprayed on tobacco nurseries to control cutworms, the need for more Field Extension work is only too apparent.

#### ENTOMOLOGICAL WORK.—TOBACCO.

*Root Eelworm*—(*Heterodera radiculicola*. Greef.)—Of the many pressing problems requiring study in connection with this crop, one of the chief is undoubtedly that of Eelworm. The matter was considered of sufficient importance to warrant enquiry being made in England in 1928 as to the possibility of obtaining the services of an Helminthologist to study the pest in the Protectorate, and in this connection I visited Professor R. T. Leiper, F.R.S., at the Imperial Bureau of Agricultural Parasitology, the subject of plant helminthology, having now been entirely transferred to this institute from the Imperial Bureau of Entomology. As was rather to be expected in view of the somewhat recent development of Plant Helminthology as a specialized subject, no trained or experienced Helminthologist was found to be available. It was, however, disappointing to realize that any help in a subject so vitally important to the practical tobacco grower in a tropical country could apparently be hoped for only in a rather remote future. Having been in contact with the subject of root eelworm in European grown tobacco under semi-tropical African conditions for some seven years, I am fully convinced that the subject must be studied *under these conditions*, and that information obtained by workers on the subject in temperate climates is likely to be of little value—may even be misleading—to those studying the problem under conditions enumerated above. While fully realizing the world wide nature of the problem of plant nematodes, it is most certainly a fact that the majority of the work done on the subject has been carried out under market garden or horticultural conditions—conditions which are in no way comparable to and have nothing in common with, local environmental factors—and I would quote from a recent letter from the Director of the Amani Institute:—"The Nyasaland problem, however, is simpler in its form since we are dealing with a single crop and with a single set of environmental conditions. Under these circumstances I regard the search for suitable remedial measures as more hopeful, although from the nature of the pest it is still likely to be exceedingly difficult. From this point of view it is essential that the investigation should be conducted on the spot".

The very nature of the problem demands a long period of preliminary work before experiments on control can even be devised, consequently each year's delay in commencing investigation is a serious matter. In the meantime the Nyasaland tobacco grower must continue to employ seedbeds on an uneconomic scale.

As regards the use of the commercial product calcium cyanide, known as "cyanogas" and which was mentioned in the pamphlet on Root Gallworm in Tobacco Seedbeds in Nyasaland (Bulletin No. 3 Ent: Ser: February, 1928), as being a possible soil sterilizing agent, it has now been shown in Florida that a dressing of 1,200 lbs. per acre is required to give any satisfactory results against root eelworm. As the price is now nearly 1s. 8d. per lb. in America, this chemical can be ruled out as being of any practical value in this connection in Nyasaland.

*Tobacco Beetle*—(*Lasioderma serripenne*. F.)—A very interesting point in the bionomics of this insect has been discovered. It was found in July in the North Nyasa district breeding in old cotton bolls in the field, and this was confirmed in October and November, when it was also found in cotton seed. The bolls in which the beetles feed and the grubs live and develop are those that have previously been attacked by cotton stainers, other insects or fungus diseases, and have dried and shrivelled up on the plant. The fact that Tobacco Beetle thus has a breeding ground in cotton fields is of the very greatest importance to tobacco growers. Scrupulous cleanliness of buildings and the frequent destruction of all scrap and waste tobacco has always been insisted upon as the only method of keeping an estate free from the pest and to these measures must now be added the recommendation that cotton should not be grown in the vicinity of buildings in which tobacco is handled, nor should seed-cotton or cotton seed be stored in such buildings. A short paragraph drawing attention to this new breeding ground of Tobacco Beetle was inserted in the *Nyasaland Times* for July 26th.

Now that a large number of tobacco-packing plants with steam heating apparatus are in existence, the most economical and satisfactory method of dealing with tobacco infested with beetle is undoubtedly treatment with steam. It has been found that in a plant giving a pressure of about 45-50 lbs. per square inch, steaming for two and a half minutes killed all stages of the beetle in leaf tobacco, but for a less period the results were rather doubtful, as grubs situated in the midribs were possibly unaffected. It is recommended that a period of not less than five minutes steaming should be given for tobacco hung up in hands or spread out on trays. In the latter case the layers of tobacco must not be so deep and thick that the steam will not penetrate them. A longer period should be given if there is any doubt as to the penetration of the heat into the midribs of the leaves. Whether the same method could be developed for the treatment of baled tobacco without completely opening up the bales has not yet been worked out. Slightly infected bales might be so dealt with successfully, but heavily infested bales, would, in all probability, have to be broken down.

The absorption by the leaf of moisture from the steam must be considered if it is desired to pack or re-bale the tobacco immediately after treatment, as the quantity of steam required to kill the Tobacco Beetle is considerably greater than that normally used merely to condition the tobacco for the process of packing.



**Yellow Stem Grub** (*Dereodius recticollis*. Mshl.)—This grub is the larva of a blunt-nosed weevil and is frequently referred to as the "Mputsi" of tobacco. A short description of its feeding habits and the food plants of the adults was given in the Annual Report for 1926. It appears to be a pest of a sporadic nature liable to occur in some fields every year, but as far as information is available at present there would seem to be only one brood early in the season that is of consequence to tobacco. In a small outbreak in December, 1928, the grubs were found to be pupating on the 27th of that month. To do this they crawl away from the plant on which they have been feeding to a distance of about one foot and there make a small earthen cell a few inches down in the soil, the adult weevil emerging some three weeks later. A dressing of "Cyanogas" to the soil gave some relief but it was again abundantly obvious that this chemical is too costly for use on an extensive scale. It is undoubtedly a serious pest where it occurs and its presence in all probability depends entirely on the plants which are in existence when tobacco is not present and which serve as food plants for the adult weevil.

**Green Shield Bugs**—(*Nezara viridula*. L. and *N. robusta*. Bist.)—An authoritative record was received early in the year of these two insects sucking the stems of young tobacco plants just below the bud and producing a wilted effect. The only other case where any extensive attack by these insects had been noticed was in the Zomba district in 1925, when bean shoots were being sucked in a similar manner. On enquiry it was found that the insects in question had in all probability come from beans in native gardens adjacent to the tobacco. The bugs are extremely common and widely distributed, having a large variety of food plants, such as cotton, castor, beans and so forth, and it is very unlikely that they will ever become a serious pest of tobacco, but may on rare occasions and in isolated places appear in slightly abnormal numbers, as in the case described above, and then be responsible for damage to a few plants.

**A Capsid**—(*Engyptatus voluer*. Kirk.)—was found in considerable numbers in March feeding on tobacco plants in the experimental plots at Zomba, and the same, or a similar species was observed ovipositing in the stems of native tobacco plants during October in the Ngerenge district of North Nyasa. Nothing further is known of the life history of this very small sucking insect, but the record is mentioned here because it is a new one for the country, and the insect may by reason of its feeding habits be connected with the transmission of tobacco diseases, and probably by reason of its small size has hitherto escaped special notice.

**Tobacco Nurseries**.—It is probably true to state that in general planters are prepared and equipped to deal with outbreaks of insects in their nurseries, but the fact that during every nursery season requests are still received by the Entomological Division for supplies of poisons or the loan of spraying machines, indicates that some estates are not so equipped. The capital outlay on machinery is certainly rather heavy and the cost of poisons purchased locally is very high, nevertheless ways and means of overcoming these difficulties should be found possible by the planting community.

**Black Stem-rot** (*Pythium aphanidermatum*)—In connection with this disease it is of interest to quote from the half yearly report of the Director of the Imperial Bureau of Mycology, of 31st March, 1929:—"Specimens and cultures of the organism to which black shank of tobacco in Uganda is attributed have been received..... The fungus is distinct from that studied by the Director in Nyasaland, but whether it is *Phytophthora nicotianae*, the cause of black shank in the Dutch East Indies and Florida, is doubtful".

#### COTTON.

Work on this crop has for several years been carried out almost entirely by the staff of the Empire Cotton Growing Corporation, the Entomological Division only dealing with the subject of cotton in the North Nyasa district. With a view to finding out if the embargo imposed in 1925 on cotton growing in this area on account of the presence of Pink Bollworm (*Platyedra gossypiella*. Saunders.) had restricted the development of this pest, the growing of test plots of cotton by Europeans during 1926 was arranged by the Department of Agriculture. It was intended that these plots should be extensively examined at different times throughout the year by Mr. C. B. R. King, the Entomologist to the Empire Cotton Growing Corporation, and the question of continuing the embargo reconsidered after such examinations had been made. Unfortunately Mr. King was transferred to the Premier Cotton Estates at Lourenco Marques during the year and so no search could be made. Another set of plots was therefore planted in 1929 and these were thoroughly examined in October and November, a short preliminary search being made in July. In this connection it is desired to record the thanks due to the African Lakes Corporation Ltd. for preparing a large test plot at Karonga, at their own expense. Search of these plots and of seed-cotton and cotton seed produced no Pink Bollworm at all. A report was rendered in December suggesting that, under certain conditions, the embargo might be removed, and later this action was sanctioned. Warning was given that the pest might re-appear after a few years of cotton growing on an extensive scale, but with the change from a two-crop to a one-crop per season type of plant in the established cotton areas, it was considered that the position was somewhat different from that existing when the embargo was imposed, and that by the adoption of complete baling in the infected area and other precautions, including the maintenance of the present cotton quarantine area to the south of the North Nyasa district, all reasonable measures to prohibit the spread of the pest would have been taken.

The actual work of searching for the Pink Bollworm was considerably hampered by the discovery that the larval and pupal stages of another small moth, *Mometa zemiodea*. Durrant, found in cotton bolls, had, under low power magnification, apparently all the characteristics usually considered specific for those stages of the Pink Bollworm moth. Prior to the finding of *M. zemiodes* in the North Nyasa district, the larva of this moth was unknown to the Entomological Division and only two pupae had been taken, in 1923 in Portuguese East Africa near Mlanje. It is of interest to record here that these two pupae cases (after the moths had hatched and

proved to be *M. zemiodes*) were taken in 1924 to the late Mr. Durrant at the Natural History Museum, who expressed the opinion that they were probably pupae of the Pink Bollworm moth! Although in the field, the larvae of *M. zemiodes* were to be found almost entirely in old or diseased bolls and could thus, in a general way, be differentiated from Pink Bollworm, it was disconcerting to find larvae and pupae in seed cotton bearing such a striking resemblance to Pink Bollworm, and with only the equipment available under camping conditions, breeding of the moths was alone a sure proof of their identity.

**Cotton Worm**—(*Prodenia littoralis* F.)—Late planted cotton on the Ndindi Marsh near Port Herald suffered in May and June from a serious outbreak of this pest, which acted as a cutworm and was reported to be most numerous on those areas where flood water from the river receded only slowly. Towards the end of the period, however, parasitism was very high, as a consignment of some 25 pupae sent to Zomba failed to produce a single moth, the majority being parasitized by a Tachinid fly (*Sturmia* sp.). The predaceous Shield Bug (*Macrorhaphis spurcator*. Wlk.), known to prey on cotton bollworms, has been found, in both its nymphal and adult stages sucking the caterpillars of the above moth, when they adopt their more normal habit of feeding on the leaves of the cotton plant.

#### TEA.

This crop continues to remain astonishingly free from insect pests of a really serious nature, work on the physiology of the plant under local conditions and its response to various methods of cultivation, pruning and plucking being a more immediate necessity than extensive entomological studies. Nevertheless with the intensive development of the crop it is only reasonable to suppose that some insect feeding on it will, sooner or later, be provided with conditions most suitable to its rapid increase, and in this connection it is interesting to note that the Entomologist to the Tea Research Institute of Ceylon in his report for 1928 points out that though the Mosquito Bug has been present in Ceylon for many years and although it has occasioned little trouble for a long time it was showing increasing activity and causing considerable loss of crop in many places. That much the same may occur in Nyasaland is not at all beyond the bounds of reasonable chance—the local insect is to be found every year in the tea and as pointed out in the bulletin on the subject (Bulletin No. 4 Ent: Ser: October 1928) it probably only requires two or three consecutive seasons with a high rainfall and little sun to bring the pest into prominence coincident with the main tea flush.

One of the main questions requiring attention in the general cultivation of tea is the provision of suitable cover and green manure crops. A considerable variety of plants have been tried by individual estate owners but it is obvious that in establishing such crops it is necessary to have more controlled experimental work requiring greater supervision than it is possible for the manager of an estate to give. In conjunction with this work it is eminently desirable to have some knowledge as to the insect pests and fungoid diseases that do, or might, attack the plants being experimented with. Under conditions where, owing to the lack of research facilities, each individual estate owner or manager “tries out” whatever plants that may seem good to him, the collection of such information is almost impossible.

A further point in the general cultivation of tea that might well receive attention is the local practice of leaving the prunings to dry on the surface of the soil before they are dug in. It has frequently been pointed out that such prunings are probably of little value under these circumstances and recent work in Ceylon<sup>1</sup> has proved that prunings and green manure loppings treated in this way will, after only a few days, lose a very large proportion of their nitrogen and a considerable amount of the organic matter they contain, particularly under conditions of alternate dry and wet weather. It should be noted that the leaf part of the material is of the most value and to obtain the greatest benefit from it this should be dug in green.

**Red Spider**—(*Tetranychus bioculatus* W-M.)—This annually recurring pest continues to be a considerable evil. Certain patches or areas of tea may be expected to become infected every year, but in addition it appears in new and unexpected places quite frequently, on the summits of ridges as well as in hollows, in tea on apparently very good soil, in old bushes, young bushes, and seems to defy climatic conditions, turning up in dry, normal and wet years. The Entomologist says that rain will check the pest and the planter points out that considerable rain has fallen but the pest is still much in evidence! If the pest has become well established and had time to produce a quantity of its fine web all over the leaf surface, it will require very heavy rain to interfere with its activities as the extremely resistant eggs are well protected by this web. It is for this reason that the use of sulphur—which is a specific control for Red Spider—either as a dust or as a spray in the form of lime-sulphur, is so strongly recommended. Areas that are known to be susceptible to the pest should be treated particularly early in the season. Red Spider carries through from one season to the next by means of eggs which are placed in crevices in the stems of the tea bush, so that the whole bush should be dusted or sprayed with sulphur *before* the pest has made itself evident on the foliage. In cases where the pest is found later in the season in isolated patches or on individual bushes it is essential, if treatment with sulphur is adopted, that an area rather larger than the infected patch or a row of bushes surrounding the individual plant should all be treated. It is useless to mark the infected bushes and try to treat them one by one. The pest is readily transported on the bodies and clothing of pluckers and field workers so that merely leaving the infected patches alone, for fear that if they were treated the pluckers might obtain leaf from sulphur-dusted bushes, is likely to result in Red Spider spreading through a whole garden and a large number of bushes becoming unsuitable for plucking instead of only a few. Enquiry should be made into the soil conditions of those areas where Red Spider occurs every year as a “hard pan” or inadequate drainage may reasonably be suspected.

1. Tropical Agriculturist, Dec: 1928. pp. 348—351.



**Leaf Weevils**—There are at least two kinds of typical, snouted weevils that may feed on the foliage of young tea plants and do considerable damage. One of these was first noticed in 1926, was shortly referred to in the annual reports for that year and 1927, and was described and figured in Bulletin No. 4 issued in October 1928, where it was called the Tea Leaf Weevil. In the annual report for 1927 a second type was mentioned as "A small black weevil (*Systates* sp. nov.) having exactly the same habits.....But it is not numerous and is of doubtful importance". During the last two years this latter type of weevil has, however, been of much greater importance than the other and it is now necessary to differentiate between them.

(1) *The Large Brown Tea Leaf Weevil*.—(*Dicasticus mlanjensis*. Mshl.<sup>1</sup>)—This is described in the bulletin referred to above. It varies in length from 8-12 mm. in breadth from 3.6-5-7 mm.

(2) *The Small Black Tea Leaf Weevil*.—(*Systates smeei*. Mshl.<sup>2</sup>)—The jet black colour of this weevil is relieved only by two small and rather indistinct white spots at the base of the wing cases. In size it is considerably smaller than the other, the largest specimens found being under 8 mm. in length.

The habits of these two weevils are much the same. Eggs are laid under the folded back tip of a leaf or between two leaves glued together: the grubs hatch in 7-10 days fall to the ground and immediately burrow into the soil where they feed on roots or other vegetative matter. They remain in the ground for the remainder of the year and the adults emerge in the next spring to feed above ground on the leaves of the plants, from the edges of which they eat out irregular semi-circular shaped pieces. Both weevils have probably been introduced into tea gardens with the "nandolo" bean (*Cajanus indicus*) (a small native tree-bean) used as a green manure. In the cases where the Black Tea Leaf Weevil has done most damage young tea had been interplanted extensively with "nandolo". In due course this was removed and the new generation of weevils, hatching later from the grubs in the soil, found only the young tea plants on which to feed. These they almost completely defoliated and as they found a suitable food plant and breeding ground in the tea, it is only reasonable to suppose that this area may be more or less seriously attacked by this weevil for some years to come. In older and fully established tea, attack by these weevils will probably be of little concern, in fact although "nandolo" has been used to some extent among old tea damage by the weevils under these conditions has not been observed. On account of these weevils alone, the use of "nandolo" as a green manure among young tea should be rigorously avoided. Further evidence as to the disadvantages of "nandolo" is given below.

**Termites**—The cutting down by white ants of young plants or the new shoots of plants after the first pruning continues to be rather serious in certain areas. The identification of the termites concerned has not yet been possible but material has now been sent to Ceylon for comparison with the termites found to be attacking healthy tea bushes there. Although there appear to be at least two kinds of termites implicated in this damage, it is possible that they are only forms of the same species and both occur in the same areas. It would seem, however, that there are two distinct modes of attack. In one case the termites first establish themselves on the shades over the young tea plants and thence extend their activities to the plant itself: in the second case older tea, having no shades is attacked. In the first case there seems little doubt that shades made from bracken fronds are extremely attractive to these white ants, as in the areas where a profusion of bracken indicates this material as being the most easily procured for this purpose the damage done by the pest is very extensive. It is possible, however, that some obscure soil factor in these areas may tend to the maintenance of a large white ant population and the dual existence of the bracken and the white ants in great numbers be merely a coincidence.

At the same time there is the purely mechanical fact that shades made from bracken fronds must, by reason of their size, be situated much closer to the plant than would larger shades made from bundles of thick grass stems and the chances of contact between the shade and the plant, enabling the white ants to move from one to the other without any difficulty, would be much less in the latter case than the former. Whether prevention against this type of attack by termites can be secured by the adoption of some particular form of shading or not deserves attention, but it would seem doubtful at present if any method of poisoning the shades can be evolved on an economical scale for practical use over a large area.

As regards the cause of attack by termites on older tea no satisfactory explanation can be given. Such attack may take place on clean land or in gardens thoroughly overgrown with grass and weeds, where prunings have been buried as well as where prunings have been carried off. The measure, recently developed in Ceylon, of boring a hole in the stem of the plant so as to reach the runway of the termites and blowing into it dry Paris Green cannot be employed in the circumstances under consideration where the stems attacked are of so small a diameter. As, however, it appears from the work in Ceylon that dry Paris Green employed in this way has no detrimental effect on the bush experiments were commenced with a view to ascertaining if the same poison merely dusted into the heart of the plant would be effective in destroying the ant colonies and prevent further attack. Results from this work are not available, but it is worth recording that proof has been established in Ceylon that there was no trace of any harmful substance in the flush of the tea bushes treated with Paris Green in order to rid them of infestations of termites.<sup>3</sup> In the meantime where attack of this sort takes place continual action is necessary to prevent the damage becoming serious and the termites well established. Poison baits of Paris Green or other form of arsenic and some carrier such as sawdust, chopped grass, weeds, bran, etc., will give some relief: continual disturbance of the soil by very light cultivation close to the plants without disturbing the roots will aid in exposing the termites to the many enemies that prey on them: but all methods must be carried on continuously or at short intervals, half-hearted measures will be of little avail. It is more than probable that the termites usually gain entry into the wood of the bushes through old pruning cuts and a very important point

1. Bull. Ent. Res. Vol. XVII, p. 213.

2. Bull. Ent. Res. Vol. XVIII, p. 261.

3. Tropical Agriculturist. May 1929, p. 307.



in this connection (and also in the prevention of wood roots and fungus diseases), is therefore the rapidity with which a callus growth is made over these cuts, though no callus can, of course, develop quickly enough to prevent immediate attack by white ants. Theoretically the flatter the cut the more quickly will a callus develop: in practice the cut cannot be made straight across the stem but in many cases it would seem that the cut is made unnecessarily sloping in local practice and it is possible that such a surface aids the attack of the termites.

*Nurseries*—Few insects other than Mosquito Bug have been recorded from tea nurseries but on one occasion ordinary Cutworms (*Agrotis* sp.) did some damage in a "dry season" nursery, and a Cockchafer Beetle (*Trochalis* sp.) and White Grubs were reported from another.

In general there still seems an inclination to "overcrowd" nurseries by sowing seed too close, particularly if it is intended to plant out two year old stumps. Unless the nursery soil is exceptionally good there must be tremendous competition among the plants for nourishment before the end of the period if they are only four inches apart, and when removing plants from a crowded nursery root systems are bound to be damaged.

*Seed Bearers*—No insects of particular importance have been found, as yet, on Tea Seed Bearers, as few of these gardens have been established for any length of time. It may be of interest to point out here, that as the tea flower depends almost entirely on cross-fertilization for the subsequent development of the seed, to ensure that this seed produces progeny at all resembling the parent *jat* the seed bearers must be well and thoroughly isolated from gardens containing bushes of an inferior *jat*.

*Diseases*—With the appointment of a Mycologist, stationed at present in the tea belt, work on this subject will no longer have to be carried out by the Entomological Division, but it may not be out of place to record observations on the following points.

One important disadvantage of the use of "nandolo" among young tea has already been mentioned, but of still greater importance is the fact that in many cases it has been observed that young tea does not grow well in the vicinity of this legume. Why this should be so cannot, at the moment, be explained. Some planters maintain that "nandolo" carries the fungus of *Dieback*, but this has not yet been proved: nevertheless, that young Indian tea alongside hedges or rows of this bean has suffered from *Dieback* (whether due to *Macrophoma* or some other cause cannot be definitely stated) to a far greater extent than similar aged bushes further away has been seen in several places, both in Mlanje and Cholo districts. Apart from anything else "nandolo" appears to inhibit the growth of young tea; and though possibly this only occurs under certain conditions as these conditions are at present unknown, it is strongly urged that "nandolo" should not be used in tea gardens, in particular amongst young Indian tea, at least until the bushes are thoroughly well grown.

Little further information as to the "Unknown Disease" or "Tea Yellows" is available. Serial observations on marked bushes, begun early in 1927, have unfortunately produced little information of value owing to the steady disappearance of the marking posts and even the bushes themselves, resulting in only three plants of the original twelve now to be found. As the work has been started afresh under the control of the Mycologist, since the visit of Dr. H. H. Storey, it would be premature to attempt any further explanation of the disease in this report.

#### COFFEE.

By reason of the more general information on the subject that has been in demand no consecutive entomological work on this crop has been possible and only the following short notes on various insects are available.

*Cameron Bug*—(*Antestia variegata*. Thunb.)—The variability of attack by this insect is being studied. The egg parasite, which is of general distribution and as a rule appears to exert some natural control over the numerical increase of the pest, is probably *Telenomus truncativentris*. Dodd.

*Coffee Leaf Miner*—(*Leucoptera coffeella* Staint.)—This very small white moth, the tiny, flat caterpillars of which mine under the upper surface of the leaf and produce an irregular shaped, brown-coloured blister, has been bred up. The main emergence of the moth would seem to take place in the dry months (e.g. August in particular) and by this time parasitism is high, three species of Chalcids having been reared. The actual damage done by this leaf miner is difficult to estimate, but if the health of the coffee bushes is maintained throughout the dry weather by good cultivation practices, it is probably not great except under abnormal conditions.

*Aphis*—(*Toxoptera aurantii*. Boyer.)—This dark coloured "green fly", commonly found on citrus trees, has been found occasionally on coffee but is not, apparently, of great importance. It is preyed upon by several ladybird beetles and hoverfly larvae.

*Spiny Leaf-caterpillar*—(*Parasa vivida*. Wlk.)—A parasitic *Ichneumon* fly (*Charops*. sp.) has been bred from these caterpillars, which are only of sporadic occurrence, and a Cuckoo Wasp (*Chrysididae*) has been reared from a pupa.

*Waxy Scale*—(*Ceroplastes ? ceriferus*. Anderson.)—The isolated occurrence of this white, waxy scale on coffee has been noticed for several years, but nowhere does it appear to have developed in any abundance. A similar scale found in enormous masses on *Cedrela toona* (referred to below) and doing considerable damage thereto gave rise to some anxiety as to whether this latter scale would spread to the coffee. Pending identification of the two insects, the opinion was expressed that they were probably different species: the scale on coffee is considerably smaller than the other, is usually closely pressed to the stem or shoot under a bud or in a leaf axil and is found as isolated individuals or at most in groups of three or four. Unfortunately this opinion has been proved to be incorrect, identification of the two scales by Dr. F. Laing of the Natural History Museum showing them to be one and the same insect. The possible spread of the scale from *Cedrela* to coffee must therefore be taken into consideration, though at present no information has been obtained of its having done so. As the insect must be indigenous to the country and as coffee is one of its food plants, it is natural to suppose that



the crop would be attacked by it even if *Cedrela* were not present. In the further reference to the scale below it will be noticed that isolated *Cedrela* trees do not appear to be attacked and any danger that there may be to coffee gardens would seem to exist only if they are adjacent to a *Cedrela* plantation. That the insect has not developed to any extent on coffee in spite of the opportunity to do so which must have been available to it, may indicate that the coffee plant is not so suitable a host plant as *Cedrela* (witness the small size of the scale on coffee), or that natural enemies have a greater control over it in the more open area of a coffee garden than in a close-planted *Cedrela* plantation and it may never be of serious consideration as a pest of coffee under local conditions.

*Diseases*—At the risk of wearisome re-iteration it cannot be too strongly emphasised that coffee land must be cleared of jungle stumps to prevent loss from the *Armillaria* root fungus.

#### MAIZE AND SORGHUMS.

*The Green Maize-Weevil*—(*Systates perblandus*. Mshl.)<sup>1</sup> has a similar life-history to the Tea Weevils. The natural food plants of this weevil are "bonongwe" (*Amaranthus* sp.) and possibly "chisosochi" (*Bidens pilosa*), and an attack on maize would seem to occur as a result of hoeing out these weeds when weevils are present. They have been found in numbers on "chisosochi" in tea gardens but they have not yet been observed to feed on leaves of the tea bushes. In captivity, eggs were always laid in a fold of the leaf not under the leaf tip, and always on "bonongwe" leaves never on "chisosochi", though both plants were available. On hatching after 8-12 days, the grubs fall to the ground and burrow into the soil, the adults emerging a year later. As with the Tea Leaf Weevils, the female is a very prolific egg layer: in one case over 900 eggs were laid in 71 batches between February 24th and May 13th, the female living four months in captivity.

*Sorghum Stalk Borer*—(*Chilo* sp.)—Somewhat severe damage by this borer was recorded from native gardens in the Fort Johnston district early in the year, but as is usually the case under these circumstances the most serious part of the damage was done before the presence of the insect was noticed. It was found to be parasitized by a Braconid (*Apanteles sesamiae*. Cam.), an *Ichneumon* and a nematode worm (*Mermis* sp.).

#### MISCELLANEOUS CROPS.

*Castor*—The larva of a moth (*Cossidae*), allied to the Goat Moth of Europe, was found boring in an isolated patch of castor oil plants in which it had done much damage.

*Vines, Figs, Fruit-trees*—Various scale insects are reported from time to time on these plants and those interested in the cultivation of them should be prepared to carry out spraying operations whenever necessary. In the case of vines it would probably be advisable to spray regularly with Bordeaux Mixture while the plants are small.

*Tephrosia*—This plant is used to some extent as a green manure among perennial crops but more particularly as a windbreak or to hold up the banks of drains and terraces, but at present no insects of great importance have been found feeding on it. The local fish poison plant (*T. vogellii*) is rather susceptible to root eelworm, and a Pyralid Moth (? *Maruca* sp.) has been bred up from a caterpillar feeding in the seed pods.

*Sunn Hemp*—Unlike the above this green manure plant possesses the very valuable character of being apparently immune to root eelworm. Two common species of Blue Butterflies have been bred from the seedpods (*Virachola antalus*. Hpff, and *Lampides boeticus*. L.) the former, at least, being parasitized by a Braconid Wasp (? *Microbracon* sp.). Of more importance are sucking insects and in one case practically all the young seed pods over some three or four acres were destroyed by a Lygaeid (*Lygaeus* ? sp.), a dark red-brown insect with a small white spot on the wings, similar in shape to the cotton stainer but only 6-8 mm. in length. The same insect is to be found on cotton and various wild legumes, but the damage done by it is not serious except when, as in this case, sunn hemp is being grown for the purpose of obtaining a supply of seed.

*Nandolo*—(*Cajanus indicus*.)—A rather severe outbreak of "greenfly" on this bean in the Zomba experimental plots in April led to a rapid survey of the insect fauna of this plant. Though far from being a complete record it was found that associated with this aphid were three species of ants,<sup>2</sup> five or six kinds of Ladybird beetles,<sup>3</sup> several species of Hoverfly larvae and chalcid wasp parasites. A month later the aphid had practically disappeared, in part no doubt due to the activities of these natural enemies. In addition a Jassid (*Empoasca* sp. nov.) was very prevalent and various weevils and Flea-beetles were also to be found. The roots of "nandolo" harbour a Root Mealy Bug<sup>4</sup> and development of this insect is very marked in the second year on ratooned plants. This legume thus carries a very large insect population and the unravelling of their interrelationship needs a great deal of study.

#### FORESTRY.

*Cedrela toona*—The serious development of Waxy Scale (*Ceroplastes* ? *ceriferus*. Anderson.) in plantations of this tree was first noticed in the Bwaila gardens, Zomba, in 1926, and was referred to in the annual report for that year.

It was then suggested that removal of the undergrowth and pruning of the trees, to allow the penetration of more light and the freer circulation of air among them, would be beneficial. Some action was taken, though possibly not to the extent that would have been desirable, and recent inspections show that the infestation is not as heavy as it was originally. Similar recommendations were made elsewhere but the action taken has been negligible.

1. Bull : Ent : Res. Vol. XVIII. p. 260.

2. *Pheidole megacephala*. F. P. *Punctulata*. Mayr : *Myrmecaria*, sp.

3. *Chilomenes lunata*. F. *Platynaspis capicola*. Crotch., var. *P. kollari*. Muls : *Seymnus trepidulus*. Weise *Seymnus* sp.

4. The larvae of *Halyzia variegata*. F. (?) are possibly predators of this scale.

The outstanding fact with this pest is that single trees or avenues of reasonably spaced trees do not become attacked and it is frequently noticeable that trees on the edge of a plantation may be only slightly infested whereas those further in are covered with masses of the scale.

It would appear necessary therefore that in a plantation *Cedrela* trees should be widely spaced and the undergrowth kept down, or preferably that *Cedrela* should only be used in a mixed plantation. Another tree on which a heavy attack by the same scale has been seen is the Pride of India (*Mella* sp), belonging to the same botanical family as *Cedrela*. Overcrowding of the trees has undoubtedly been conducive to the development of the scale and if wider planting produces a poorer type of timber then consideration must be given as to whether the *Cedrela* tree is suitable for this country. If the trees are cut out, it should be noted that *Cedrela* stumps are extremely susceptible to *Armillarea* root disease.

*Mahogany*—Caterpillars of *Heteronygmia leucogyna*. Hamps., defoliating these trees in the Chiradzulu district, were reported in April by the Forest Officer at Limbe. This type of attack occurs to a greater or less extent every year, but normally the pest is kept under control by natural enemies, mainly egg parasites.

*Mlanje Cedar*—Some vividly coloured, black and yellow, caterpillars found feeding gregariously on a cedar tree spun a light communal web in which to pupate. The moths hatching therefrom were identified as two species of Hypsiidae (*Amphicallia thelwalli* Druce, and *A bellatrix*. Dalm.,) and a parasitic fly (*Polychnomyia flavohalterata*. Bisch.) was also reared from them.

*Eucalyptus*—Identification was made by the Imperial Bureau of Mycology of the fungus "*Rhizoctonia bataticola*" (Taub) Butl. as being the cause of the death of young *Eucalyptus* plants. This weak parasite can only be combatted by creating and maintaining good soil conditions, and as it is extremely prevalent continual attention must be paid to this work, particularly in nurseries.

#### LOCUSTS AND GRASSHOPPERS.

Early in the year it was feared that stray swarms of locusts from Tanganyika Territory might possibly penetrate as far as Nyasaland, more particularly by way of the northern part of Portuguese East Africa whence it might not have been easy to obtain information as to their movements, but fortunately these fears were not realized. Previous records of locust invasions of Nyasaland refer to the Brown Locust (*Locustana pardalina*. Wlk.) from South Africa, swarms of the Desert Locust (*Schistocerca gregaria*. Forsk.) of North and East Africa not having been known to reach as far south as this country. In connection with the possibility of a locust invasion, however, a request to all District Commissioners to report any unusual grasshopper activity elicited interesting information, from several areas, concerning semi-gregarious types of grasshoppers that had hitherto escaped notice.

Reports with specimens were received from the Bwanje Valley, Ncheu; the Tamanda Plain, Mlanje; and Port Herald. These grasshoppers consisted mainly of three species,<sup>1</sup> all of which are eaten with avidity by the natives who turn out in numbers to collect them. These swarms, containing all three species together, hide low down in the grass stems during the heat of the day, and do not appear to do any serious damage to the native crops. In the Tamanda Plain the natives stated that these swarms occur nearly every year and obviously looked upon them as something of a luxury. On the other hand, amongst the specimens from Port Herald was a long-horned grasshopper<sup>2</sup> which was reported to be doing considerable damage to ripe "mapira" (millet) and maize cobs, a somewhat unusual record for this insect. The local name for this species is "Mphombo" and it was stated to be seen flying in small clouds at dusk. Previously only isolated specimens had been taken in the Shire Highlands.

#### IMPORTATION OF PLANTS.

Legislation governing the importation of plants has now been revised, so that information must be given in advance to the Department of Agriculture of the source of supply of the consignment it is desired to import. Plants procured from a registered nurseryman in a country where an organised plant inspection service is maintained, such as South Africa or Rhodesia, are in all probability free from pests and diseases and further examination can, in most cases, be dispensed with. This should be a great benefit to importers, as, if this regulation is honestly complied with, delay in delivery of plants can be avoided. Lists of quarantined nurseries are now supplied monthly by the Plant Regulatory Service of South Africa, which will assist the Department in the granting of importation certificates. The unauthorized introduction of plants by travellers entering the country by the Salisbury-Tete road which was at one time occurring, will now, it is hoped, be checked by the establishment of a customs office near the border.

#### CONCLUSION.

In dealing with the more serious pests of annual crops, such as the stalk-borers of maize and sorghum, there is some evidence to show that the seasonal incidence of these insects, though dependent to a great extent on the climatic conditions of the season, lies nevertheless between certain wide dates, possibly covering a period of two months. As the crops are most open to attack by certain insects at a certain stage of the plants' development it follows that if the time when the female insect is ready to lay eggs coincides with this stage of the plants' growth serious damage to the crop will be the natural result. One method of avoiding, or at least lessening, this attack is, therefore, to plant seed at such a time that the crop will have reached a stage where it cannot suffer much damage when the insect appears, or conversely to delay planting so that the insect will not find a suitable food supply in which to lay eggs. Such a practice has been known and carried out by cultivators over most of the world for very many years, and it is a method of combating insect pests eminently suitable for employment by natives in their food gardens. It is probable that native agriculturists have a certain amount of inherited knowledge on this subject

1. *Oxyrrhypes procera*, Burm. *Cataloipus cegnatus*. Wlk *Cyrtacanthacris aeruginosa*. Stoll:  
2. *Homorocoryphus vicinus*, Wlk:



but it is obvious that a great deal more precise information is required concerning the specific pest of the crop being dealt with and the reaction of the plant to certain times of sowing, necessitating the development of early or late maturing types, as the case may be. This information can only be obtained by a number of accurate observations over a period of years, and moreover these observations, to be of value to the native cultivator, must be made under the elevation and climatic conditions which he will encounter in his own garden: information obtained in the Shire Highlands is not likely to be applicable to the lake shore areas, for example. In addition, by adopting a certain planting time to avoid the ravages of one insect, may be to place the plant at the mercy of another, hitherto of no importance, so that a very wide survey of the possibilities of insect attack on each crop is essential, and at present the necessary information can only come slowly.

C. SMEE, M.C.,  
Entomologist.

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#### RECENT PUBLICATIONS.

##### *Entomological Series.*

Bull: No. 3—Root-gallworm in Tobacco Seedbeds in Nyasaland. February, 1928.

Bull: No. 4—Tea Mosquito Bug in Nyasaland and Notes on Two Potential Pests of Tea. (Illustrated.) October, 1928.

Bull: No. 5—Insects in Tobacco Seedbeds. January, 1929. (Issued August, 1929.)

Bull: No. 6—Locusts and their Destruction. April, 1929.

## Report of the District Agricultural Officer, Fort Johnston.

As I am proceeding on leave to England before the close of the year I feel it desirable to submit a brief report on the work carried forward from 1928.

It is to me a matter of considerable regret that owing to the smallness of the European agricultural personnel no officer is available to relieve me to carry on the work in hand; there must therefore be a break in its continuity which is the more to be deplored in that an advance likely to prove definitely advantageous to native interests has now been achieved.

The District Commissioner, Major C. B. Nichols, M.C., however has very kindly offered to direct and supervise as best he can the work of my native agricultural staff here who will follow out a general plan of work drawn up provisionally for his guidance.

*Meteorological*—The season's rainfall October 28th to April 16th, was 23.27 inches.

*General*—Whilst the food situation generally throughout South Nyasa district is satisfactory the early cessation of the rains had an adverse influence on sorghum crops and also on the cotton crop especially where grown on the lighter soils. Boll worm incidence was high and wide spread. Ground-nuts suffered in certain instances on account of the heavy rains in the first half of March which were coincident with the ripening period of the nut.

*Cotton*—The native cotton growing industry makes but slow recovery from the blow it sustained under the adverse climatic conditions of 1926, the crop production per capita of those engaged in the industry actually dropping as it did then from over 100 lbs. to under 40 lbs. In that year the seed issues were two and a half times greater than the issue which produced a 142 ton crop of seed cotton in 1925 (our best record since the war), and, had 1926 conditions been favourable, there is little doubt that the industry would have established itself on a top record of somewhere in the vicinity of 200 to 250 tons for the District.

As things now stand improvement this season, consequent on my consistent and repeated efforts, shows an increase of 410 gardens in South Nyasa and an increase of 61 gardens in my Kalembo section of the Liwonde District, a total increase of 471 gardens over the number of gardens that had been definitely established in 1928.

There are also 21 more villages in South Nyasa and 20 more villages in the Kalembo area, engaged in cotton growing this season than there were last. Whilst I anticipate a further increase for 1929/30, time alone will prove if the recovery is to be a complete one. Apart from other factors one of the greatest offsets against cotton cultivation as a cash crop for the native of this district is, from his standpoint, the long duration from the time of planting to the marketing of the produce. The native tends to lose interest in a year of food plenty and becomes indifferent to making the most of the crop, while in a year of food scarcity he is so obsessed with the prospect of hunger that his attitude becomes one of resigned apathy. Another factor adversely affecting cotton particularly around Lake Malombe is the development of a fish industry consequent on the expansion of the Lake area. Cotton is allowed to remain ripe in the field for the owner finds fishing far more lucrative.

It being important to have figures on the native grown cotton crop a series of average gardens were measured up, the sales' receipt slips of owners will be brought in and the acre yield and value worked out therefrom. It will then be possible to see at a glance the value of cotton relatively to other crops now of potential economic importance e.g. maize, ground-nuts, rice, etc., which are only awaiting cheaper transport facilities to allow of their inclusion in Nyasaland's list of exports.

*Native Food Crops*—a. Production figures of native-grown maize, rice and ground-nuts (1929). These data were in each instance obtained from a series of 10 average gardens.

Crop.	Average Garden Acreage.			Computed Average Yield per Acre.
Ground-nuts	...	.234 acres.	...	922 lbs. unshelled nuts.
Rice	...	.222 "	...	1,622 lbs. unhulled rice.
Maize	...	.738 "	...	1,417 lbs. shelled maize.

b. *Sorghum* (Mapemba)—The study of this cereal was continued. 1,140 lbs. of seed were selected and issued free to natives with the object of influencing improvement both in the yield and quality of a native food crop so popular. The demand for selected seed was encouraging and the value of the results seemed to be quite definitely recognized by those who had availed themselves of the issue so much so that there seems every probability that there will be a still greater demand for such issues in the future.

It was found that the natives' own unselected seed produced at the average rate of 334 lbs. to the acre whilst the crop grown from the selected seed returned a yield averaging 475 lbs. to the acre. Data were obtained from seed planted in a series of gardens in one area under the same set of climatic and cultural conditions and of soil. This represents a 42% increase attained by rough selection in the field a result sufficiently striking for one to warrant the assumption that even greater improvement may yet be obtained.

*Rice*—It is gratifying to report that there is a tendency for this crop to be more extensively cultivated throughout the district.



In view of the potentialities of the district for rice growing which have been so vastly enhanced by the rise of Lake Malombe it is, I think, to be deplored that the impetus which had been given to its cultivation by its acceptance in lieu of hut tax has been removed. There can be little doubt that assured of a market a great development of this crop could take place for its cultivation appeals strongly to many natives.

*Ground-nuts*—A tour of the Chikala-Kawinga section of the Liwonde District was made in conjunction with the District Commissioner, Mr. J. O'Brien, to view the potentialities of the area for the growing of ground-nuts. I consider that all conditions are most favourable to the production of this crop. The native there is also sympathetically disposed to its cultivation and awaits only an assured market. Parenthetically it may be remarked that the most of the Lake-shore areas, as also the rest of the Shire basin, are equally suitable for the cultivation of ground-nuts.

*Experimental work on the areas at "Mtumbwasi" and "Mbaluku"*—*Maize*—The comparative trials of Potchefstroom Pearl maize against the local native maize "Mkozi" was repeated but it is regretted that owing to the activities of white ants stands were much depleted.

The trials were carried out in 12 alternating plots each of 1/40th acre. Check plots under a Yellow Kango maize were included in the series.

The data obtained are included in the table below—

Variety	Actual yield per acre part stand	Computed full stand yield per acre	Shelling percentage	Seed yield per 100 cobs
	lbs.	lbs.	per cent.	lbs.
Mkozi ... ..	1,227	2,013	77	22'4
Yellow Kango ... ..	1,113	2,132	75	24.
Potchefstroom Pearl ... ..	1,220	2,209	82	25'2

*Tobacco*—The varieties under trial included Cash, Hickory Pryor, Yellow Mammoth, Melton and Western. Planting out conditions were hardly ideal and complete stands were eventually obtained only with some difficulty. A sample of each variety was fire cured under improvised conditions and the cured leaf so obtained showed promising qualities.

The actual weights of green leaf harvested placed "Western" an easy first.

Variety	Yield
Western ... ..	4,020 lbs. green leaf to the acre.
Cash ... ..	2,670 " " " " " "
Hickory Pryor ... ..	1,830 " " " " " "
Yellow Mammoth ... ..	1,831 " " " " " "
Melton ... ..	1,416 " " " " " "

*Cotton*—Strain "B" one of the Empire Cotton Growing Corporation's selections has yielded at the rate of 625 lbs. and 475 lbs. seed cotton per acre at "Mtumbwasi" and "Mbaluku" respectively. At the former area planting was a month later than at the latter area.

*Ground-nuts*—In the variety trials of ground-nuts the local nut "Ntedza wenandi" has again proved to be the highest yielder under the conditions of the experimental area here.

The average yield over the seasons of trial is shown below.

Spanish Bunch ... ..	550 lbs. per acre—average for two seasons
Gambia (Basse variety) ... ..	928 " " " " " "
Chimbuwila (Naisi—an Empire Cotton Growing Corporation selection) ... ..	913 " " " " " four "
Ntedza wenandi (local Fort Johnston seed) ... ..	1,071 " " " " " " "

The superior yield of the local seed over imported varieties and the "Naisi" selection is noteworthy.

*Echinochloa frumentacea* (Chindumba)—This hardy three to four month cereal crop which I am still endeavouring to popularize in the district returned a yield of 1,700 lbs. to the acre at "Mbaluku" this season.

*Finger-millet*s—Of the eight forms of this cereal under trial the two outstanding were the short term "Kangumba" (S. Nyasa) with a yield 1,360 lbs. to the acre and the full term "Usanje nankulu" (S. Nyasa) yielding 1,320 lbs. to the acre.

FRANK BARKER,  
District Agricultural Officer.

## Report on the Work of the Cotton Experiment Stations, Season 1928-29

### INTRODUCTION.

*Staff during the Year*.—Mr. Miller was in charge of the Makwapala Station until April, when he proceeded to Port Herald. Mr. Ducker proceeded on leave in November, returning in April. During his absence Mr. Lochrie was acting Cotton Specialist, and, in addition to the routine duties of the post, had charge of the Port Herald Station. On Mr. Lochrie's departure on leave in May, Mr. Ducker assumed control of Makwapala, Mr. Miller remaining at Port Herald.

### SUMMARY.

Though in part the report on the Makwapala Station is a record of failure, the season at this station has not been without its brighter points, and it seems probable that the fresh ideas engendered by this partial failure may yield valuable results.

It has been increasingly obvious since 1925 that the weakest point about Makwapala is its soil; this is a residual loam, resting on metamorphic gneisses and schists, which under the climatic conditions of the area has become highly laterised. Under conditions of cultivation this laterised loam has developed an ironstone pan relatively impermeable to water, which under the Makwapala conditions gave rise to extensive erosion. As has already been reported, efforts have been made to check this erosion, by means of graded ridge terraces, with a fair measure of success, but the problem of the pan, formed before these measures were tried, remains.

The experience of this and past seasons at Makwapala is that, while early maturing shallow-rooted crops like maize and tobacco do well as long as there is no superficial water logging, cotton and other late maturing deep-rooted crops suffer severely immediately the rains cease and the surface soil dries out.

There is, however, one notable exception, Pigeon Pea (*Cajanus indicus*), known locally as nandolo, which is undoubtedly capable of breaking up the pan and reaching the subsoil moisture. This crop remains green throughout the dry season and makes its crop five months after the rains have ceased.

It would seem that this crop can do what the local flora, mainly *Brachystegia* spp. appear able to do, break up any pan formed and in some measure reverse the procedure of pan formation. An extensive trial is therefore being given to it in the rotation practice at Makwapala.

In addition, attempts are being made to increase the depth of the surface soil by cultivation. A modification in ploughing methods has resulted in an increase of four inches in the plough depth of previous years.

An extended programme of organic manuring has been adopted since there are indications that the pan formation is associated with the loss of humus by the soil.

The Over-the-Top variety of cotton, selected before the soil problems of the station became acute, and helped by the exceedingly favourable season of 1926-27, has, in the past two seasons, shown increasing difficulty in coping with the conditions, and it is pleasing to note that U. 4 obtained from Barberton has shown signs of being better able to do so. It seems very probable that Nyasaland will have as much reason to be grateful to Mr. Parnell as has S. Rhodesia, since this strain has in the past season shown itself as suitable for Port Herald as for Makwapala.

As has been reported before, cottons taken from Makwapala and tried out elsewhere under better soil conditions have nearly always done better than on the station, and it is of interest to note that a 10-acre plot of Over-the-Top B at Karonga has this season given the highest recorded yield for Nyasaland, 1,220 lbs. seed-cotton per acre, about 390 lbs. lint per acre, of which 374 lbs. was clean and white. This strain has displaced Nyasaland Upland almost entirely in areas other than the Lower Shire, and it will be of interest to see whether it in its turn will be displaced by U. 4.

The Port Herald Station has had the best season, as far as results go, since its commencement, and a big step forward has been made towards a reasonably complete knowledge of Lower Shire problems. Enough already has been learnt to suggest the possibility of increasing the present crop by up to 50 per cent. merely by getting all sowing done within a certain period of time, and energetic propaganda may see this done within the next season or so.

Two strains from S. Africa, U. 4 from Barberton and Cambodia 664 from Gatooma, have overtopped all else, and the records made indicate that these two should be the Port Herald cottons for 1930. Confirmation of this season's results and a seed-bulking scheme, at present under consideration, can be put in operation, and the present Lower Shire seed stock replaced by a better strain.

Further attempts have been made without success to extract an improved strain out of the ordinary Nyasaland Upland. Several hundred single plant selections have now been grown on the stations, but none has so far proved satisfactory. The conclusion has therefore been reached that this strain as it now exists is more or less incapable of improvement by straight selection and that it will be best to concentrate on the imported strains, especially U. 4 which shows such promise.



A possible explanation of our lack of success is that practically all Nyasaland Upland seed available is descended from a more or less pure line selected in the past by the Department of Agriculture, and that the difficulty of extracting off types of promise is augmented by the lack of definiteness of the jassid attack. The writer has only twice in Nyasaland seen anything approaching the definiteness of the attack by jassids seen by him at Barberton last year, and in neither case was this on Nyasaland Upland.

#### MAKWAPALA EXPERIMENT STATION REPORT FOR THE SEASON 1928 29.

*Season*—Early and promising rains were followed by a dry spell which lasted until the first week of January and to a considerable degree offset the advantages of the early start.

As in previous seasons, a wet, dull spell occurred in March which favoured the pests rather than the cottons, and was also a difficulty where the tobacco curing was concerned. It must be feared that this spell of cold wet weather is a normal event at Makwapala, and that, unless some modification in the methods of cultivation, or change in the variety overcomes its effects, it will be a source of trouble to cotton in most seasons. The only year in which this spell has not occurred since cotton-growing was commenced at Makwapala was in 1926/27, when the record crop for the station was grown.

*General*—The work of the station has continued on lines similar to those of the past three seasons.

Several more implements have been obtained for the cattle, all of which have done good work. Special mention must be made of light spring tine cultivators obtained from Ransomes, and of Ransomes R. H. R. L. ridger. Fuller realisation of the troubles due to the ironstone pan reported last season has directed attention to the need for improved cultivation. A modification in the ploughing methods made possible by the new implements has considerably increased the ploughdepth. The procedure consists in rough-ridging the land after the first ploughing, ploughing between the ridges, splitting them back with the ridger and ploughing again between them. The depth broken has thus been increased from about 5 to 9 inches without undue mixing of the soil and subsoil.

A stock of upwards of 50 tons of a farmyard manure compost has now been accumulated and an extended programme of organic manuring is under way. There is evidence that the hardening of the lateritic ironstone pan with which the station is afflicted is in part connected with loss of humus by the soil. A heavy application of organic manure to next season's maize crop should help to throw some light on this matter.

The ridge terraces have stood up well, but some minor difficulties arose due to local and temporary waterlogging above the terraces. This it is hoped has been got over by improvements to the grade of the terraces and by leaving a water furrow on their upper side. The method of breakwaters in the drains reported last season promises to be successful in controlling erosion. It is of value in allowing grass to become established in the drains.

#### FIELD EXPERIMENTS.

Part of field 4 and of field 8 were used for plot experiments. Spacing, and ridge and flat experiments were sown in field 8 in repetition of last season's work, a set of manurial experiments in field 4. Over-the-Top B was used for all plots, which were laid out in a half drill eight times replicated strip array.

The spell of hot dry weather immediately following their planting combined with extensive millipede attack reduced stands so considerably that nothing could be done but attempt re-sowing when the rains recommenced. Almost perfect stands were obtained on all plots with the second sowing, but were so late as to be useless.

All that can be said about these sets of plot experiments is that they were an excellent demonstration of the uselessness of late-sown Over-the-Top under the Makwapala soil and climatic conditions. The amounts of seed cotton picked were negligible.

#### COTTON BREEDING WORK.

*Farm Bulk Sowings*—Over-the-Top mixed bulk was again used as the main cotton and gave results strictly comparable with those obtained last season; 192 lbs. seed cotton per acre as against about 200 lbs. per acre last year. These results may again be compared with those obtained from this strain outside the station under better soil conditions, which in general may be given as about 400 lbs. per acre, i.e. double last year's yield.

The comparatively low yield may be again attributed to the two factors mentioned in last year's report, viz., the laterisation of the subsoil and the loss of surface soil due to erosion. Lines on which these are being attacked have already been discussed.

U. 4 was the outstanding cotton on the block. Rather less than  $\frac{1}{2}$  acre gave 291 lbs. seed cotton, 200 lbs. of which was clean and white, and it would appear that in this strain we have a cotton which can cope with bad conditions more efficiently than will Over-the-Top. In fact, if it had not been for the performance of this strain, the outlook for cotton at Makwapala would have been much blacker. The strain's performance greatly impressed a number of visitors to the station at picking time.

Cambodia was of interest in that it confirmed the deductions made from the Over-the-Top plots on the score of bad soil conditions. Up to the close of the rains this plot looked most promising, but directly the surface soil commenced to dry it went right off, and the final crop was negligible. The lateness of this strain is greatly against it succeeding under the conditions now prevailing at Makwapala.

The incidence of the pests was very like that of the previous season and no points of interest other than those previously reported were recorded.

Until studies of the root development of U. 4 and Over-the-Top have been made and the results of attempts to improve the soil conditions known, it seems unlikely that anything further of interest in connection with the pests will be noted.

#### PORT HERALD COTTON EXPERIMENT STATION REPORT FOR THE SEASON 1928/29.

*Season*—Well distributed rains throughout the planting season gave Port Herald a most excellent start, and though the late rains usually expected in July were delayed until the first week of August they came in time to do the crop much good. Altogether it has been a most excellent year for the Lower Shire, and the result is not only a record crop for the Port Herald Station, but an expected record crop of 5,000 bales for the native growers.

*General*—The work of the station has continued on lines similar to those of the past two seasons, and there is nothing new to report about the rotation crops in general.

Two new introductions have been made which show promise, namely, a strain of sorghum from the Premier Cotton Estates and the Canavalia mentioned in last year's report. Further work will be done on both.

The Sabul plough tried out at Makwapala has now been introduced to Port Herald and has proved a great success. Plans for further stocking of the station with cattle-drawn implements are under consideration.

The problem of bulking improved seed stocks for the Lower Shire area is also under consideration. After due thought it has been decided that this can probably be most economically done by organising a co-operative cotton-growing scheme on the 4,000 acres of native gardens surrounding the station. This area is rather well delimited by a line of hills, two rivers, and a block of privately owned land. It consists of a stretch of level soil equal in quality to that of the station and is well populated. The District Commissioner is very kindly taking a census of the population and gardens of the area and plans are being formulated for putting the scheme into operation.

#### FIELD EXPERIMENTS.

In marked contrast to Makwapala the field experiment work at Port Herald has this season given excellent results.

A series of spacing, time of planting, and variety trials were laid out on the lines of last year's work.

The eight times replicated half-drill strip layout was used for the spacing and time of planting experiments, but a six times replicated randomised plot layout was used for the variety test on account of the large number of varieties under trial.

Profiting from last year's experience, all strains which had showed jassid susceptibility were discarded.

Rows of jassid susceptible Foster Whitehall G were used as a control, but were planted too late to breed up the pest. It was a non-jassid year at Port Herald, some minor attack in the early stages rapidly disappearing.

The greatest increase over the standard is given by the unthinned spacing. This is a near approximation to the arrangement favoured by the natives, and its possible significance is of interest.

There is no significant difference between the other spacings, and this being the third year that such observation has been made, the conclusion must be drawn that, within wide limits, at a 4 ft. row width, spacing has little influence on the Port Herald yields. Time of planting appears to be a much more critical factor.

*Time of Planting Experiment*—This experiment was inconclusive last year owing chiefly to the fact that the Foster Whitehall strain G used suffered severely from jassid. In spite of this, the experience of the past two years, backed by that of the natives, points to the inadvisability of January sowings being made at Port Herald. It was, therefore, decided to confine the times of planting to the range February 1st to April 1st, using February 15th as standard.

Satisfactory stands were obtained of all series, using Foster Whitehall H. 2-2. The balance of the field was sown with this strain on February 15th. Observations of the various series in the field are most interesting. From being nicely graded in size according to age, the various series levelled up until there was but little difference in outward appearance to be seen between February 1st, 15th, and March 1st sowings. March 15th never quite caught up in growth, while April 1st was throughout noticeably behind the others. Pickings were taken on September 3rd, 16th, and 27th, and on October 5th and 18th. The plots were then uprooted.

The optimum planting date would this season appear to lie between February 15th and March 1st, probably the rain of February 25th would have been the best sowing rain of the period. Last season there were indications that the optimum date for sowing cotton was about March 7th, the previous season favoured February 15th. It may, therefore, be taken that somewhere between February 15th and March 15th lies the probable optimum date for planting cotton in most seasons. The natives' sowing dates range between March 1st and May 1st for the most part, with probably the majority of the gardens sown after March 15th. It would, therefore, seem probable that an alteration of the general planting time on the Lower Shire by say one month, making the main



sowings between February 1st and April 1st, would result in an appreciable increase in production. The difference between February 1st and April 1st amounts in the experiment to 50 per cent. in favour of the former.

*Variety Trial*—Port Herald has possessed rather a superabundance of strains during the past two years, and though last season's experience with jassid enabled a number of strains to be discarded, the number retained as promising was still rather large. It was, therefore, considered advisable to devise an eliminating trial.

The number of varieties to be tested plus their standard amounted to eight strains in all, and from motives of economy it was decided to abandon the half-drill strip layout in favour of a set of randomised plots giving six replicates per variety. The standard 5-row  $\frac{1}{40}$ th acre plot was used.

The plots were planted on February 18th, supplied on February 26th, and good stands were obtained throughout. A slight initial unevenness of growth was quickly smoothed out and the whole series were thoroughly comparable.

The delay in arrival of the late rains rendered the comparison of the various strains of particular interest. Two—U. 4/5 and G. C. 664/1—stood out above all others. There was little to choose between them; if anything the Cambodia G. C. 664 was the hardier. Both were markedly drought resistant. Pickings were commenced on September 9th, and the plots were picked again on September 20th, 30th, October 10th and 21st, and then uprooted.

There is a difference, possibly significant, in favour of Nyasaland Upland as compared with Over-the-Top. This agrees with previous information as to the unsuitability of the latter for the Lower Shire.

There are no significant differences between Nyasaland Upland and the Foster Whitehalls and Andrew 12, while the Cambodia and U. 4/5 are definitely superior to all else.

There can be no hesitation in concentrating work on these two strains this coming season.

#### COTTON BREEDING WORK.

*Bulk Sowings*—The main cotton sown on the station was Foster Whitehall strain H of which three sub-strains were sown.

Five acres of H-2-2 yielded 3,031 lbs. seed cotton,  $2\frac{1}{2}$  acres of H-3-8, 1,684 lbs. and  $2\frac{1}{2}$  acres of H-3-2, 1,762 lbs, all first grade. This average yield of 646.7 lbs. per acre is very satisfactory, but, as has been demonstrated by the variety test, is no more than would have been given by ordinary Nyasaland Upland. All three strains of H are remarkably like Nyasaland Upland in appearance and mainly differ from it in having a rather better ginning percentage and staple length, and an even habit due to their being pure lines.

*Progeny Rows and Observation Bulk*—Field 9 and the S half of field 11 were used for these plots. The range of types given in last year's report was sown, and in addition observation plots were sown of Bancrofts from Rustenburg and Gatooma, U. 4 and Cambodia from Gatooma, and Ishan from Nigeria.

It may be said at once that U. 4 and Cambodia completely eclipsed in performance all other types, the delay in arrival of the late rains emphasising the differences between these and other strains. As far as possible all seed produced on the breeding plots was selfed, using the flower tying method previously reported.

A large range of types was selected from the U. 4 and Cambodia bulks for progeny rows, and satisfactorily large selfed and unselfed bulks of seed of each obtained. Both will be given an extensive trial this coming season both at Port Herald and at the new Domira Bay Station which has just been opened, as well as in the case of U. 4, at Makwapala and on a large number of outside observation plots.

Several of the U. 4 selection made by Mr. Lochrie last year have done well, and at least two will be bulked for comparison with the parent bulk.

The Cambodia strains from Gatooma proved to contain a number of rogue plants apparently derived from an Egyptian cross. Efforts were made to destroy all such cross bred, and the replacement of the bulk by selected stock should complete the purification.

#### INSECT PESTS.

It has been a non-jassid year at Port Herald, and the delay in the late rains enabled stainers to be controlled early. The amounts of stained cotton picked were so small as to be negligible.

Bollworm attack was normal and suffered its usual decline into insignificance during July.

Aphis is the only pest calling for special mention. During the long dry spell preceding the August rains a heavy attack of aphis developed and it was particularly noticeable on the Andrews 12 plots. This strain is markedly inferior to U. 4 and Cambodia in drought resistance, in spite of its hirsute leaves and strong resistance to jassid, and it suffered so severely during the dry spell as to be almost completely defoliate. Practically its whole crop consisted of bolls formed when regeneration followed the August showers. The aphis was of direct value in emphasising the drought resistance of the better strains.

H. C. DUCKER,  
Cotton Specialist,  
Empire Cotton Growing Corporation.

## EUROPEAN AGRICULTURE.

Name of District.	Total Acreage under cultivation.	TOBACCO		TEA.		SISAL FIBRE.		COTTON.		COFFEE.		RUBBER.		CHILLIES AND CAPSICUMS.	
		Acreage under crop.	Yield cwts.	Acreage under crop.	Yield cwts.	Acreage under crop.	Yield cwts.	Acreage under crop.	Yield cwts.	Acreage under crop.	Yield cwts.	Acreage under crop.	Yield cwts.	Acreage under crop.	Yield cwts.
Lower Shire	6,442	58	197	...	...	5,984	18,409	120	96	...	...	...	...	...	...
Chikwawa	831	56	155	...	...	...	...	600	234	...	...	...	...	9	32
Central Shire	709	481	1,152	...	...	...	...	26	26	60	36	...	...	...	...
Cholo	14,854	5,415	10,669	1,330	1,174	2,286	6,185	9	7	75	10	...	...	...	...
Mlanje	11,671	1,398	2,479	7,529	14,896	...	...	155	130	71	38	...	...	27	43
Blantyre	7,334	2,823	6,939	...	...	...	...	66	66	484	500	...	...	10	9
Chiradzulu	4,012	1,235	2,886	...	...	...	...	8	13	...	...	...	...	...	...
Zomba	4,972	2,706	6,263	...	...	...	...	52	17	115	51	...	...	7	25
Upper Shire	164	88	392	...	...	...	...	4	5	...	...	...	...	1	2
South Nyasa	1,923	1,322	3,646	...	...	...	...	2	2	23	10	...	...	...	...
Ncheu	1,958	1,286	3,152	...	...	...	...	110	35	364	475	...	...	...	...
Dedza	655	376	866	...	...	...	...	12	7	21	10	...	...	4	7
Fort Manning	235	181	418	...	...	...	...	...	...	2	...	...	...	...	...
Lilongwe	1,407	1,268	4,695	...	...	...	...	5	5	...	...	...	...	...	...
Dowa	678	486	1,575	...	...	...	...	20	13	...	5	...	...	...	...
Kota Kota	46	...	...	...	...	...	...	...	...	3	...	...	...	...	...
Kasungu	9	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mombera	16	...	...	...	...	...	...	...	...	...	...	...	...	...	...
West Nyasa	1,341	...	...	...	...	...	...	...	...	...	...	...	...	...	...
North Nyasa	926	90	400	7	3	...	...	30	82	107	16	1,330	1,407	...	...
Total	60,177	19,269	45,788	8,866	15,573	8,270	24,594	1,219	738	1,331	1,151	1,330	1,407	58	118



EUROPEAN AGRICULTURE—CONTINUED.

Name of District.	MAIZE AND MILLETS.		BEANS.		GROUNDNUTS.		WHEAT.		POTATOES.		MISCELLANEOUS.		TIMBER AND FIREWOOD.		Acres under crop.		Yield cwt.s.	
	Acres under crop.	Yield cwt.s.	Acres under crop.	Yield cwt.s.	Acres under crop.	Yield cwt.s.	Acres under crop.	Yield cwt.s.	Acres under crop.	Yield cwt.s.	Acres under crop.	Yield cwt.s.	Mucalypus acres.	Others acres.	Acres under crop.	Yield cwt.s.	Acres under crop.	Yield cwt.s.
Lower Shire ...	205	1,000	17	24	7	110	...	...	...	...	8	90	33	10	...	...	...	...
Chikwawa ...	136	670	30	60	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Central Shire ...	28	316	10	20	...	...	...	...	...	...	3	...	44	57	...	...	...	...
Cholo ...	420	5,236	797	1,627	10	160	40	68	...	...	85	103	4,072	315	...	...	...	...
Mlanje ...	1,616	10,097	287	756	4	16	4	14	...	...	102	10	739	339	...	...	...	...
Blantyre ...	446	4,659	205	323	8	26	9	5	...	...	168	259	2,921	194	...	...	...	...
Chiradzulu ...	287	3,560	128	247	10	32	9	22	...	...	87	45	2,157	91	...	...	...	...
Zomba ..	717	6,858	139	520	40	150	12	47	...	...	336	246	612	246	...	...	...	...
Upper Shire ...	55	260	3	20	11	84	...	...	...	...	...	...	2	...	...	...	...	...
South Nyasa ...	92	1,398	11	27	8	35	6	32	...	...	2	2	247	210	...	...	...	...
Ncheu ...	88	720	9	33	...	...	...	...	...	...	1	6	71	29	...	...	...	...
Dedza ...	24	90	6	25	...	...	26	61	24	459	...	...	122	40	...	...	...	...
Fort Manning	...	...	14	43	4	20	6	56	...	...	...	...	15	13	...	...	...	...
Lilongwe	28	413	2	14	...	...	...	...	...	...	10	...	15	79	...	...	...	...
Dowa ...	18	181	5	12	...	...	31	47	...	...	7	9	55	50	...	...	...	...
Kota Kota	20	500	5	5	...	...	4	18	1	10	1	2	...	12	...	...	...	...
Kasungu	...	...	...	...	...	...	...	...	...	...	...	...	2	7	...	...	...	...
Mombera	...	...	...	...	...	...	...	...	...	...	...	...	...	10	...	...	...	...
West Nyasa	...	...	...	...	...	...	...	...	...	...	...	...	5	6	...	...	...	...
North Nyasa	265	4,165	192	1,590	2	32	156	1,606	12	175	12	139	32	21	...	...	...	...
Total	3,845	40,117	1,860	5,256	104	659	303	1,976	37	644	812	911	11,144	1,729	...	...	...	...

# NATIVE AGRICULTURE.

District.	Seed Cotton.	Rice.	Wheat.	Ground- nuts.	Tobacco.	Maize.	Peas and Beans.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Lower Shire	1,809	—	—	—	—	—	—
Chikwawa	1,248	—	—	—	—	—	—
Central Shire	195	—	—	—	—	—	—
Cholo	—	—	—	—	76	—	—
Mlanje	14	—	—	—	168	—	—
Blantyre	10	—	—	—	176	—	—
Chiradzulu	—	—	—	—	408	—	—
Zomba	—	—	—	—	282	—	—
Upper Shire	18	—	—	—	5	—	—
South Nyasa	18	—	—	—	1	—	—
Ncheu	47	—	—	—	55	—	—
Dedza	51	—	—	—	104	—	—
Fort Manning	—	—	—	—	10	—	—
Lilongwe	—	—	—	—	1,801	—	—
Dowa	95	—	—	—	795	—	—
Kota Kota	—	—	—	—	—	—	—
Kasungu	—	—	—	—	—	—	—
Mombera	—	—	—	—	—	—	—
West Nyasa	—	—	—	—	—	—	—
North Nyasa	—	—	—	—	—	—	—
Total	3,505	—	—	—	3,881	—	—

NOTE.—Maize is the staple foodstuff in most districts; groundnuts, rice, wheat, beans, and various other crops are also grown by natives for local consumption, but it is impossible to make an accurate estimate of the quantities of any of these crops.

The above tobacco figures represent the quantities purchased in each district, and do not accurately reflect the production by districts, as many natives grow their tobacco in one district and sell in another.

## NATIVE LIVE STOCK, AS AT 31ST DECEMBER.

District.	Cattle.	Sheep.	Goats.	Pigs.
Lower Shire	57	1,200	8,500	6,000
Chikwawa	148	125	719	2,000
Central Shire	520	315	2,600	751
Cholo	78	352	1,958	5,170
Mlanje	90	600	4,000	3,000
Blantyre	1,022	1,007	4,240	687
Chiradzulu	1,690	2,019	7,284	7,656
Zomba	1,000	764	763	400
Upper Shire	46	3,812	9,180	77
South Nyasa	1,259	10,459	11,243	9
Ncheu	11,640	4,417	27,160	6,666
Dedza	17,281	15,000	26,000	9,000
Fort Manning	928	2,482	3,274	1,588
Lilongwe	21,476	14,000	38,000	4,000
Dowa	17,214	15,700	27,421	11,345
Kota Kota	2,319	3,151	7,681	1,966
Kasungu	3,527	3,778	3,101	—
Mombera	31,500	6,550	12,800	72
West Nyasa	3,349	320	1,870	—
North Nyasa	30,825	970	3,650	50
Total	145,969	87,021	201,444	60,437



LIVE STOCK OWNED BY EUROPEANS AT 31ST DECEMBER.

District.	Cows and Heifers over one year	Bulls.	Oxen.	Calves.	Pedigree Cattle.	Horses.	Mules.	Donkeys.	Sheep.	Goats.	Pigs.
Lower Shire ...	708	15	366	347	1	...	...	...	19	...	...
Chikwawa ...	175	8	218	47	...	...	...	13	5	...	8
Central Shire ...	40	4	47	31	...	...	...	1	5	29	8
Cholo ...	1,298	45	1,540	688	8	1	...	20	181	27	71
Mlanje ...	866	23	905	344	2	...	...	9	116	34	75
Blantyre ...	1,492	30	1,233	734	8	4	1	5	23	84	129
Chiradzulu ...	823	4	706	277	9	...	...	22	58	...	49
Zomba ...	1,312	20	1,684	492	23	1	2	33	297	15	78
Upper Shire ...	6	1	2	7	...	...	...	...	14	57	54
South Nyasa ...	405	11	190	204	1	...	...	1	140	139	20
Ncheu ...	351	13	261	161	3	...	...	7	46	56	113
Dedza ...	347	14	269	180	...	...	...	51	145	12	165
Fort Manning ...	80	2	60	19	...	...	...	11	20	...	17
Lilongwe ...	154	5	95	116	...	...	...	24	81	17	92
Dowa ...	44	2	28	23	...	...	...	3	30	...	28
Kota Kota ...	41	1	11	17	2	...	...	5	36	...	...
Kasungu ...	...	...	...	...	...	...	...	...	23	...	...
Mombera ...	11	2	6	4	...	...	...	4	...	...	2
West Nyasa ...	11	1	10	2	...	...	...	...	16	...	11
North Nyasa ...	153	11	230	85	...	...	...	2	84	14	22
Total	8,337	212	7,861	3,778	57	6	3	211	1,339	484	942









